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THESIS

A METHODOLOGY FOR NAVAL BASES AND STATIONS REQUIREMENTS ANALYSIS: THE CASE OF THE NAS MOFFETT FIELD

by

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September 1985

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T222877

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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)*: A Methodology For Naval Bases and Stations Requirements Analysis: The Case of the NAS Moffett Field	5. TYPE OF REPORT & PERIOD COVERED: Master's Thesis, September 1985 / 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Stephen A. Luhrman	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Naval Postgraduate School, Monterey, California 93943-5100	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: Naval Postgraduate School, Monterey, California 93943-5100	12. REPORT DATE: September 1985 / 13. NUMBER OF PAGES: 136
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)*: Unclassified / 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Naval Information System Methodology (NISM)
Requirements Analysis
NAS Moffett Field
Bases and Stations Architecture
Information Systems

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This research proposes a methodology for designing an information systems architecture for Naval Bases and Stations--the Naval Information System Methodology (NISM). The proposed methodology is developed from the Business Systems Planning (BSP) and Structural Analysis and Design Technique (SADT) approaches. It allows a naval base to develop organizational information models, determine command information

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S/N 0102-LF-014-6601

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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A Methodology For Naval Bases and Stations Requirements Analysis: The Case of the NAS Moffett Field

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requirements for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS

for the

NAVAL POSTGRADUATE SCHOOL
September 1985

ABSTRACT

This research proposes a methodology for designing an information systems architecture for Naval Bases and Stations--the Naval Information System Methodology (NISM). The proposed methodology is developed from the Business Systems Planning (BSP) and Structural Analysis and Design Technique (SADT) approaches. It allows a naval base to develop organizational information models, determine command information requirements, and assess information and organizational structures. Additionally, NISM serves as a framework for defining the prototype architecture. An analysis of the NAS Moffett Field is used as an illustration. It help shed various insights into information resource management of naval bases, such as an ADP strategy for the future.

TABLE OF CONTENTS

I. INTRODUCTION.....11

A. PURPOSE OF THE STUDY.....11

B. SCOPE OF THE STUDY.....14

II. THEORETICAL AND METHODOLOGICAL APPROACHES TO INFORMATION REQUIREMENTS ANALYSIS.....16

A. INTRODUCTION.....16

B. THE ORGANIZATIONAL SUPPORT SYSTEM.....17

C. AN ANALYTICAL FRAMEWORK: THE WATERFALL MODEL.18

D. PREVIEW OF REQUIREMENTS ANALYSIS METHODOLOGIES.....24

E. DATA FLOW DIAGRAMS (DFD).....31

F. STRUCTURED ANALYSIS AND DESIGN TECHNIQUE (SADT).....35

G. SYSTEMATIC ACTIVITY MODELING METHOD (SAMM)....39

H. BUSINESS SYSTEMS PLANNING (BSP).....43

I. BUSINESS INFORMATION ANALYSIS AND INTEGRATION TECHNIQUE (BIAIT).....50

J. CRITICAL SUCCESS FACTORS (CSF).....52

K. SUMMARY OF MODELS/CHOOSING A MODEL.....54

L. DATA COLLECTION TECHNIQUES.....57

III. A NAVAL INFORMATION SYSTEM METHODOLOGY (NISM).....63

A. METHODOLOGY.....63

B. STEP 1: GAINING THE COMMITMENT.....66

C. STEP 2: PREPARING FOR THE STUDY.....69

D. STEP 3: STARTING THE STUDY.....70

1. Organizational Mission.....71

2. Environmental Survey.....71

3. Individual Department Surveys.....74

E. STEP 4: DEFINING STATION PROCESSES.....75

F. STEP 5: ANALYZING CURRENT SYSTEMS SUPPORT....84

G. STEP 6: DEFINING THE INFORMATION STRUCTURE...86

H. STEP 7: DETERMINING THE COMMANDING OFFICER'S PERSPECTIVE.....93

I. STEP 8: DEFINING FINDINGS AND CONCLUSIONS....94

IV. DESIGN IMPLICATIONS FOR THE NAS MOFFETT FIELD....105

A. INFORMATION COORDINATION.....105

B. INTERPRETATION OF THE PROCESS AND ORGANIZATION MATRIX.....111

1. Administrative Processes.....113

2. Inventory Processes.....113

3. Human Resources Processes.....115

4. Personnel Lodging Processes.....118

5. Material Processes.....118

6. Facilities Management Processes.....118

C. IMPLICATIONS AND SUGGESTIONS.....120

V. CONCLUSIONS.....125

APPENDIX A: NISM CHECKLIST.....129

LIST OF REFERENCES.....133

INITIAL DISTRIBUTION LIST.....135

LIST OF TABLES

I. BIAIT QUESTION TABLE.....51

II. COMPARISON OF REQUIREMENTS ANALYSIS METHODOLOGIES.....55

III. TIME DIMENSION TO THE NISM STUDY.....95

IV. FUNCTIONAL RELATIONSHIP TO DEPARTMENTS TABLE....107

LIST OF FIGURES

2.1 Waterfall Model.....20

2.2 Electronic Fund Transfer Life Cycle.....23

2.3 Current Physical/Logical DFD.....33

2.4 SADT Datagram/Actigram Structures.....37

2.5 SADT Command Muster Report.....38

2.6 SAMM Model of Division Muster Report.....41

2.7 BSP Study Flow.....44

2.8 Process and Organizational Matrix.....46

2.9 Process and Data Class Matrix.....47

3.1 Naval Information System Methodology (NISM).....64

3.2 NAS Moffett Field Chain of Command.....73

3.3 Administrative Department.....76

3.4 Civilian Personnel Department.....77

3.5 Human Resources Management Department.....77

3.6 Security Department.....78

3.7 Public Works Department.....78

3.8 Supply Department.....79

3.9 Comptroller Department.....79

3.10 Operations Department.....80

3.11 Aircraft Intermediate Maintenance Department.....80

3.12 Weapons Department.....81

3.13 Recreational Services Department.....81

3.14 Process and Organizational Matrix, Moffett Field.83

3.15 NISM Hierarchical Decomposition.....97

3.16 Level A0 - NAS Moffett Field.....98

3.17 Level A1 - NAS Moffett Field.....99

3.18 Level A2, Number R2 - NAS Moffett Field.....100

3.19 Level A2, Number R3 - NAS Moffett Field.....101

3.20 Level A2, Number R4 - NAS Moffett Field.....102

3.21 Level A3, Number R5 - NAS Moffett Field.....103

3.22 Level A4, Number S1 - NAS Moffett Field.....104

ACKNOWLEDGMENT

The author wishes to express his gratitude to Captain J. D. Piccioni, Commanding Officer of the NAS Moffett Field, and Captain A. L. Wilson, Executive Officer of the NAS Moffett Field, for their support and the assistance of their staff in the field research for this paper. Particular thanks to Mr. Hesterly G. Hankins, ADP Coordinator of the NAS Moffett Field, for his advice and guidance.

I. INTRODUCTION

A. PURPOSE OF THE STUDY

The objective of this thesis is to provide a methodology for analyzing a naval station in order to determine Automatic Data Processing (ADP) needs. A brief background of the Bases and Stations Architecture project is required for the reader to appreciate the purpose of the objective.

In April 1984, NAVDAC (Naval Data Automation Command) proposed the Bases and Stations Architecture project [Ref. 1]. The thrust of the project was to develop Automatic Data Processing prototypes based on analyses of a few naval stations [Ref. 1]. Eventually, a consolidated prototype architecture would be implemented at selected naval bases and stations [Ref. 2]. Organizational prototypes are to be developed for naval stations in FY-86, and naval air stations in FY-87 [Ref. 2]. The scope of the project coupled with the proximity of target dates exemplifies the concern by Navy leaders that information processing at naval stations deserves improvements.

A question that surfaces immediately is, why did NAVDAC choose to develop a prototype architecture? Why not choose the alternative strategy and analyze each naval station separately to design software and hardware specifically for each naval station? The author believes that the decision

to develop a prototype architecture was the preferable alternative because economies of scale would help decrease the overall cost and development time of the project. Given that naval stations share many of the same functions, the software for these common functions need only be developed once; i.e., to develop the prototype architecture. Since software development is a costly and time consuming effort [Ref. 3:pp.17-18 and Ref. 4:p.4], developing software for common naval station functions could curtail redundancies of effort.

Consideration must be given to the extent that a prototype architecture, developed from a few naval stations, will apply to other naval stations in general. It is the author's opinion that missions and environments differ enough that problems will develop should a standard prototype architecture be applied across the spectrum of naval stations. The author believes that a prototype architecture is the preferable strategy for improving information management at naval stations on a grand scale; however, the prototype architecture should be used only as a framework to develop each naval station's computer system. An illustration will clarify the author's viewpoint.

As previously mentioned, naval stations share many functional similarities. For example, all naval stations will generate reports to submit to higher authorities. However, the structure of the organization will determine

how data are collected and compiled, and who generates the report. The types of reports themselves will often vary from command to command depending on their mission (e.g. some naval stations support port services) and their environment (e.g. command relationship - Pacific versus Atlantic Fleets). Although the report function is shared by all naval stations, differences in mission and environment will not allow a standard prototype architecture to exactly fit a specific naval station's requirements. Like fitting a square wood block into a round hole, a degree of carving must be done.

This thesis suggests a methodology for analyzing a naval station so that the prototype architecture may be shaped. Indeed, the same techniques could be used to analyze the selected naval stations for development of the prototype architecture itself.

The products of the methodology provide a summary of organizational processes to a naval station Commanding Officer to aid in his/her management of information and assessment of the organizational structure. Additionally, the products serve as a summary of information processes and relationships within the command, which can be useful to an incoming Commanding Officer. Such a turnover package, allows an incoming Commanding Officer to quickly determine command operations.

A study of a particular naval station was needed to develop the methodology. The Naval Air Station at Moffett Field was chosen due to its diverse functional processes and proximity to the author's work location (i.e., Naval Postgraduate School). The research of the NAS Moffett Field will be used to illustrate the methodology in subsequent chapters.

B. SCOPE OF THE STUDY

This thesis will develop a set of tools for understanding information flow in an organization so that information resource decisions can be made in an orderly manner. These tools will be organized to develop the methodology of this thesis - Naval Information Systems Methodology (NISM). The results of a NISM study could be used to implement the Bases and Stations prototype architecture, by adapting the prototype to fit the specific organizational information needs of each naval station.

Chapter 2 provides a theoretical and methodological background on aspects of information requirements analysis. It begins with a discussion of the objective of the computer system development. This is followed by an examination of the actual phases of computer system development. Next, a review of six specific requirements analysis methodologies will be undertaken. From this review, the tools to develop the NISM can be defined. Actual data collection techniques to formulate a requirements analysis model are discussed.

Since Chapter 2 essentially focuses on background material to develop the methodology of this thesis, the reader who is interested only on practical issues might prefer to skim this chapter.

Chapter 3 proposes a Naval Information System Methodology (NISM). An analysis of the NAS Moffett Field is used to illustrate the techniques and products.

Having applied the NISM to the NAS Moffett Field in Chapter 3, Chapter 4 draws various conclusions from the results. For example, the preferred system concept and alternative concepts for the NAS Moffett Field.

Chapter 5 will expand the findings of Chapter 4 into other naval stations and their information requirements.

II. THEORETICAL AND METHODOLOGICAL APPROACHES TO INFORMATION REQUIREMENTS ANALYSIS

A. INTRODUCTION

Prior to developing the methodology of this thesis, it is appropriate to provide the reader with an overview of computer system development concepts. In this way, the reader will be able to understand the issues underlying the author's choice of techniques.

The overall objective of computer systems development should be defined. That is, what does an organization expect from a computer system? The concept of an Organizational Support System will address this question.

Having defined the ultimate objective, it is appropriate to discuss how to get there. The software life cycle explains the stages of computer system development. By discovering where the Bases and Stations Architecture project is and what stages the project must still go through, the reader will be able to appreciate the rationale of the project's development strategy.

With this overview in mind, Section D will set the stage to begin discussion of requirements analysis methodologies. This preview will describe what the requirements analysis process is all about. Following the preview, six requirements analysis methodologies will be reviewed. The

reader will then be able to understand the techniques that the author selected to be used in the Naval Information System Methodology (NISM).

The final theoretical area to be discussed concerns data collection techniques. In order to apply any of the requirements analysis techniques, data needs to be collected. Section L will survey methods to do this.

Since this chapter focuses on theoretical aspects, the reader concerned with the practical application of the NISM may prefer to skim this chapter. In this way, Chapter 2 can serve as a reference to understanding theoretical issues as the reader progresses through this research.

B. THE ORGANIZATIONAL SUPPORT SYSTEM

The objective of computer system development is to implement an Organizational Support System (OSS) [Ref. 5]. The latter is not simply a computer system or information system. The Organizational Support System concept must be recognized to consist of data, procedures, people, hardware, and software which will mirror the organization and support organizational goals.

> "It is important to understand that OSS aims at improving the effectiveness of an organization than just the efficiency of individual operations . . . . Effectiveness is a measure of the degree of goal-achievements" [Ref. 5:p. 4].

Thus, an Organizational Support System can be viewed as a system that is integrated into an organization which may or

may not comprise computer systems. The goal of the Organizational Support System is to improve the way an organization conducts business. The word "improve" infers a measurement against some standard. Generally, an improvement means a reduction in total costs over some defined period for some fixed level of output, or an incremental increase in profits. However, intangible benefits are also important and may be evaluated to exceed the Organizational Support System costs; e.g., mission management may be out of control such that an Organizational Support System is judged to be necessary in order to bring the mission under control.

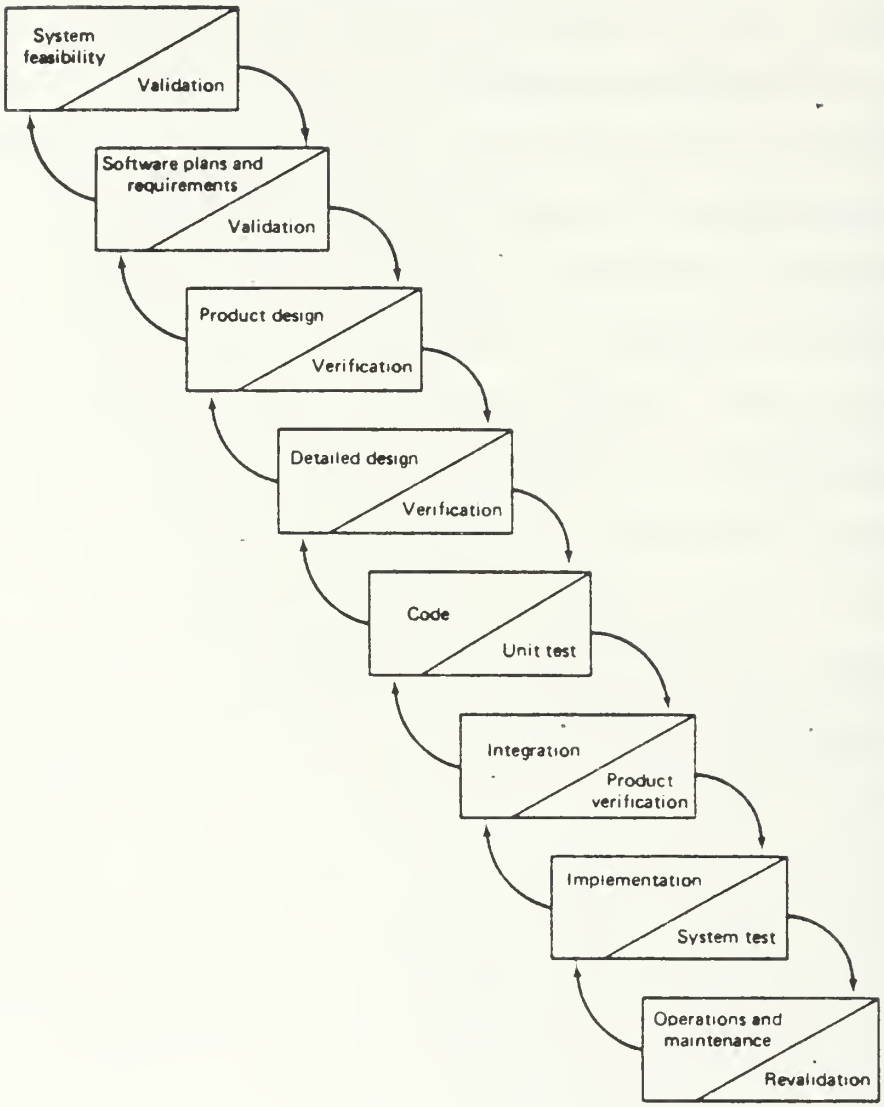
C. AN ANALYTICAL FRAMEWORK: THE WATERFALL MODEL

The software life cycle provides a general sequence of events that transpire in the analysis, design, implementation, and operation of software. The software is married to the hardware to form a computer system.

Various models of the software life cycle appear in the literature. The title of phases and details vary somewhat between authors depending on their viewpoints. For example, Pressman [Ref. 4] identifies three main phases, while Martin and Finkelstein [Ref. 6] define 12 steps.

Since all authors seem to follow the same logical sequence involving system evolution, it makes little difference which viewpoint is taken for the reader to develop a general understanding of system development. The

Waterfall Model [Ref. 3] will be used for this thesis. Figure 2.1 depicts the Waterfall Model [Ref. 3:p. 36], which consists of 8 phases beginning with System Feasibility. During the System Feasibility phase, a preferred software product concept is defined, its feasibility determined, and its superiority to alternative concepts itemized. The Bases and Stations Architecture project is currently in the System Feasibility phase, attempting to define the prototype architecture. During the next phase, Software Plans and Requirements, the analysis is continued in order to specify software functions, interfaces, and performance. The next phase, Product Design, specifies the overall hardware and software architecture. During the Detailed Design phase, the software architecture is fully defined; i.e., software module functions, software control structures, module interfaces, and module sizing are defined. The next phase, Coding, begins the actual programming activities to develop the modules that will comprise the software product. During the Integration phase, the various software modules are incorporated and tested to form a functioning software product. The Implementation phase finally unites the software product to the hardware, creating the Organizational Support System; during the Implementation phase, the users receive training on the system. The Operations and Maintenance phase is the final phase of the Waterfall Model. It is at this point that a fully



[Ref. 3:p. 36]

Figure 2.1 Waterfall Model

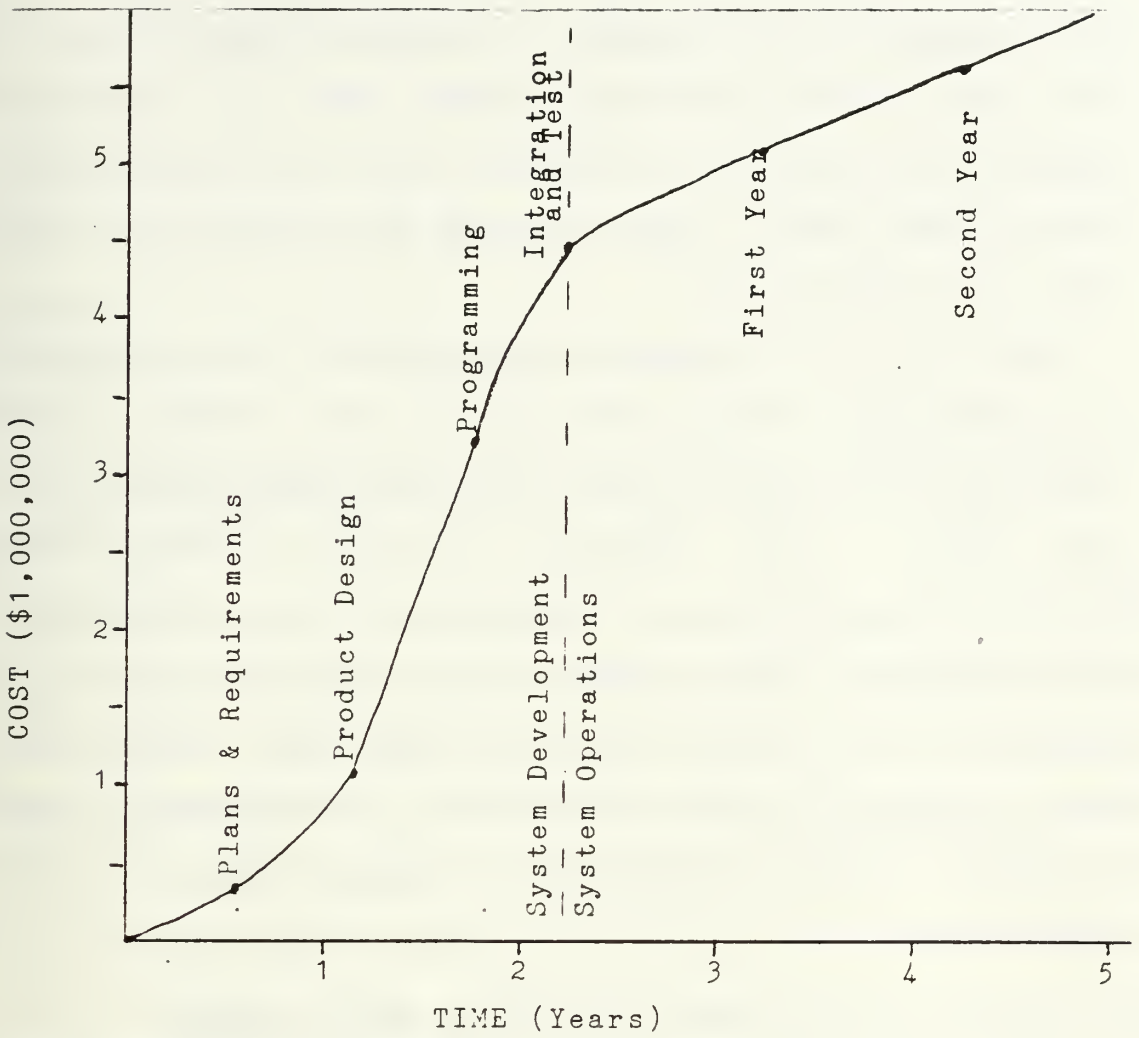
functioning Organizational Support System hopefully accomplishes the work it was intended to do. Furthermore, software maintenance is conducted to update the system as organizational requirements change.

This brief description of the Waterfall Model sketches the evolution of an Organizational Support System. The Waterfall Model describes a traditional software life cycle; i.e., from an idea to a fully functioning system. The development of the Bases and Stations prototype architecture could follow a traditional software life cycle, similar to the Waterfall Model. However, the implementation of the prototype architecture at each naval station will not require such a rigorous path [Ref. 3:p. 41]. With a prototype architecture already defined, the prototype needs only to be tailored to fit each individual naval station; that is, the effort for many of the Waterfall Model phases can be minimized. For example, a prototype architecture module for tracking Unaccompanied Officer Personnel Housing (UOPH) would be installed at naval stations where UOPH requirements exist; i.e., the Product Design, Detailed Design, and Coding phases have already been completed during the development of the prototype architecture and need not be repeated.

Any software life cycle project requires costs and development time. There are models that can estimate the cost and development time for a software product. The

Constructive Cost Model (COCOMO) [Ref. 3] is one such model. Figure 2.2 graphs the cost versus time for an example software product using COCOMO. The software product is a bank's electronic fund transfer system [Ref. 3:pp. 103-106]. Although the example described in Figure 2.2 has little to do with naval stations, it does provide the reader with an appreciation for the costs and development times necessary to produce software. Referring to Figure 2.2, it should be noted that more than 2 years elapse prior to the organization commencing operations with the computer system. Additionally, it should be noted that the costs of Programming (i.e. Coding phase) and Integration and Test (Integration phase) are extremely significant; Programming comprises 49% of the development costs while Integration and Test comprise 27% of the development costs. For this example, should an individual software development project be accomplished for each branch of the bank, the cost would probably be prohibitive; i.e., a prototype architecture would be a preferable strategy. As a final note, Figure 2.2 does not consider hardware costs to complete the system; i.e., the hardware that was specified in the Product Design phase must be added to the costs described on Figure 2.2 if one desired a total system cost.

As discussed previously, a prototype architecture simplifies the necessary effort required for installing an Organizational Support System at each naval station. The



COCOMO Model Assumptions

1. Embedded-mode development (i.e., tight constraints, complex hardware, software, and operational procedures)
2. Product size - 80,000 delivered source lines of code
3. Annual software changes - 15% of total product
4. Personnel cost = $72,000 per person annually

Item	Schedule(month)	Personnel	Cost($)
Plans & Requirements	6.8	8.1	330,480
Product Design	7.0	17.9	751,800
Programming	7.6	47.8	2,179,680
Integration & Test	5.4	37.8	1,224,720
Maintenance	every 12	8.7	626,400

[Ref. 3:pp. 103-106]

Figure 2.2 Electronic Fund Transfer Life Cycle

prototype will provide a pool of software modules [Ref. 4:p. 338]. It is the author's opinion that an analysis is required at each naval station to determine which modules are desirable and to define how the modules will interface within the organization.

Referring to the Waterfall Model (Figure 2.1), it should be noted that during the first two phases (System Feasibility and Software Plans and Requirements) an analysis takes place. This analysis is called a Requirements Analysis and results in a definition of the Organizational Support System. From the Requirements Analysis results, the Organizational Support System is designed in the third phase, Product Design. Subsequently, the software is coded and tested, and the Organizational Support System is finally implemented.

D. PREVIEW OF REQUIREMENTS ANALYSIS METHODOLOGIES

Up to this point, this chapter has discussed global issues of computer systems development. With this as a background, the remainder of this chapter will focus on specific issues of Requirements Analysis.

The Requirements Analysis task is accomplished by an iterative decomposition of data, organizational processes, and data/people relationships into a descriptive model. Taken as a whole, the model will reflect the detailed methods of the organization's mission.

Of course, a model is merely a representation of reality. If the model does not truly reflect the characterization of an organization, the system engineers will construct a system which does not fulfill organizational needs.

Professor R. M. Graham once said,

> "We build systems like the Wright brothers built airplanes--build the whole thing, push it off a cliff, let it crash, and start over again" [Ref. 7:p. 36].

The quote is an overstatement, but the fact remains that some systems do not fulfill organizational objectives. This consequence can often be attributed to an inadequate Requirements Analysis [Ref. 7]. Consider a yeoman position at one naval station. There are a variety of tasks and interactions that must be performed to fulfill his/her organizational niche. The tasks performed by the yeoman will interact with activities accomplished by the division chief. The activities performed by the division chief will effect the division officer's activities, and so on. Thus, as the analysis proceeds up the organizational hierarchy, duties and interactions become more complex and less well-defined. To develop the model, each person, process, and current machinery within an organization must be analyzed and detailed. Decomposing an organization is a difficult procedure. Describing the decomposition in a model which will accurately reflect operations is a fastidious task.

The primary difficulties of accomplishing a sound Requirements Analysis are:

1. The communication of abstract concepts from a user to an analyst to a design engineer. None of these professionals speak the same language or fully understand the other's environment.

2. The lack of emphasis; all personnel, users and design firm alike, want to get on with the coding. Everyone wants to see a physical system and observe work accomplishment, justifying the capital investment.

3. Organizations have inherent processes which are often unstructured and people-decision dependent; these processes are therefore difficult to capture and dissect. That is, some essential organizational processes are conflicting or "have no rhyme or reason" to the analyst.

4. The design firm's desire to simplify and fit the organization to the computer system, rather than designing the computer system to integrate with the organization.

5. The tools available to the analyst are inadequate. The models attempt to detail and communicate an organization, but all of them have shortcomings.

With the advent in the 1970's of real time processing, remote data communications, database management techniques, and new software techniques, Decision Support Systems (DSS) and Distributed Data Systems (DDS) became available to organizations. These new complex applications further exacerbated the problems in accomplishing a successful Requirements Analysis.

The next paragraphs of this chapter will concentrate on six of the Requirements Analysis methodologies. These particular methodologies were selected for the discussion.

since each of them offer a technique that could be applied towards the objective of the thesis. Additionally, a discussion of each of these methodologies will provide the reader with an overview of representative Requirements Analysis approaches and products. Each method has strengths and weaknesses, such that no methodology is suited for all organizations. All of the methodologies broached attempt to model the organization as a system.

Before beginning the discussion, it would be useful to provide a general classification of the methodologies so that the reader can keep in mind the scope of the techniques. Requirements Analysis methodologies generally fall into two categories based upon the model developed. Datalogical models view the organization as consisting of data objects which are processed at various organizational levels to form information objects at other organizational levels. For example, a supply requisition for paper is information to a supply clerk filling the order, but serves as data for the Supply Officer to calculate total paper requisitions. To the Supply Officer, total paper requisitions serves as information, but to the Commanding Officer total paper requisitions serves as data; the Commanding Officer is more interested in total requisitions, which is viewed as information by him/her. Thus, "data becomes information when they undergo a transformation

involving infusion with purposeful intelligence" [Ref. 8:p. 18]. Data Flow Diagrams (DFD), Structured Analysis and Design Technique (SADT), and Systematic Activity Modeling Method (SAMM) fall into the datalogical category. The second category,infological models, describe the information structure of an organization. That is, what is information to what level in the organization, who owns the information, and who needs the information to fulfill their mission. For example, the Supply Officer owns requisition information which the Commanding Officer needs, but the Weapons Officer does not need. Business Systems Planning (BSP), Business Information Analysis and Integration Technique (BIAIT), and Critical Success Factors (CSF) fall into this category.

In a traditional software life cycle, an infological model will be followed by development of a datalogical model. The infological model describes a macro view of the organization. The detail is not sufficient yet to begin system design. However, information management decisions can be made. These decisions will provide a basis on which to conduct a follow-on analysis which will construct a datalogical model. The datalogical model will provide the necessary detail to begin design of the Organizational Support System.

For the datalogical models, it is useful to examine a common transaction in order to clarify the differences in methodologies. Therefore, a command muster report will be

examined in discussions of DFD, SADT, and SAMM. The division musters will be physically taken by Chief Pace and Chief Coffee. Their respective division officers, Ensign Fast and Lieutenant Sharp, will check the musters and forward them to the department head, Lieutenant Commander Cash. LCDR Cash will check the two division reports, and forward them to the Personnel Department where Petty Officer Trim will consolidate all muster reports and give a report to the Commanding Officer, Commander Wise. Command policy is for the Commanding Officer to have the muster report by 0830.

The reader should keep in mind that Requirements Analysis methodologies are more complex than the following discussion. The author has eliminated some detail in order to keep the objective of the discussion in focus; i.e., to provide the reader with a general overview of Requirements Analysis techniques. References are cited should further study be desired.

The discussion of Requirements Analysis methodologies will compare attributes of each methodology, as well as provide a general overview of each technique. The list of attributes to be compared are described below.

1. Top-down approach. The focus is on organizational goals and objectives. They serve as the driving force behind development of the system [Ref. 8:pp. 390-391].

2. Datalogical model. A model that views the organization as consisting of data objects, which are processed to form information objects [Ref. 5].

3. Infological model. A model that describes information structure of an organization [Ref. 5].

4. The model's relationship to organizational structure. From the model, organizational positions or jobs can be related to the activities [Ref. 5].

5. The model's ability to relate physical data flow to logical data flow. Does the model relate how organizational personnel deal with the data, to the processing that is undertaken on the data [Ref. 9]?

6. The model's representation of processing controls. The controls to information processing activities are depicted [Ref. 10].

7. The model's ability to prioritize activities. That is, does the model describe which activities must be completed prior to when a subsequent activity can be accomplished [Ref. 10]?

8. The model's ability to prioritize processing of input and output. Assuming all inputs cannot be received by a process simultaneously, does the model describe a priority for inputs to be received prior to processing? Similarly, assuming all processed information cannot be output simultaneously, does the model describe a priority schedule for output [Ref.5].

9. The technique's ability to define when decomposition is completed. Does the technique define when the analysis is completed [Ref. 5]?

10. The model's adaptibility to computer support. Can the model be developed and checked using computer systems [Ref. 10]?

Following the discussion of Requirements Analysis methodologies, a summary comparison will be accomplished. This will enable the reader to understand the rationale behind techniques that the author selected for the Bases and Stations prototype implementation analysis. Following the development of the methodology suggested in this thesis, an

examination of analysis data collection techniques will be discussed.

E. DATA FLOW DIAGRAMS (DFD)

DFD is a datalogical model which decomposes physical data flow to yield a graphical product. DFD was proposed by DeMarco [Ref. 9] and the technique was extended by Yourdon and Constantine [Ref. 11]. DFD is a very common analysis technique which is described in several texts (for example, Ref. 4 and Ref. 5).

The DFD product is a series of bubbles representing information transformations, arrows representing data flow. and boxes representing information sources and sinks. All of these diagrams are represented in a hierarchical set of layers; e.g., a squadron readiness report would represent the lowest layer, a wing readiness report would represent the next layer up, and so forth, until reaching the top readiness report layer at the Commander and Chief level.

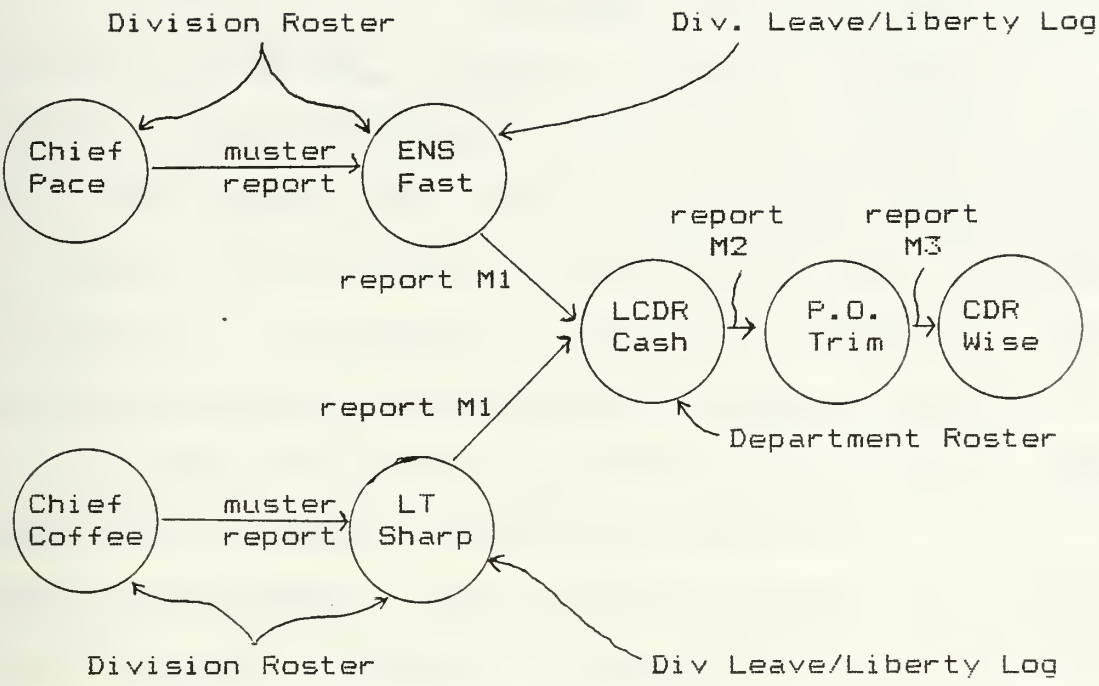
The diagrams are arranged into sets of four; Current Physical Data Flow Diagram, Current Logical Data Flow Diagram, New Logical Data Flow Diagram, and New Physical Data Flow Diagram. The two "current" DFD's are what the analyst uncovered, and the two "new" DFD's represent an improved method of doing tasks through integration of an Organizational Support System.

Referring to our command muster report example, Figure 2.3 would represent a layered Current Physical DFD and

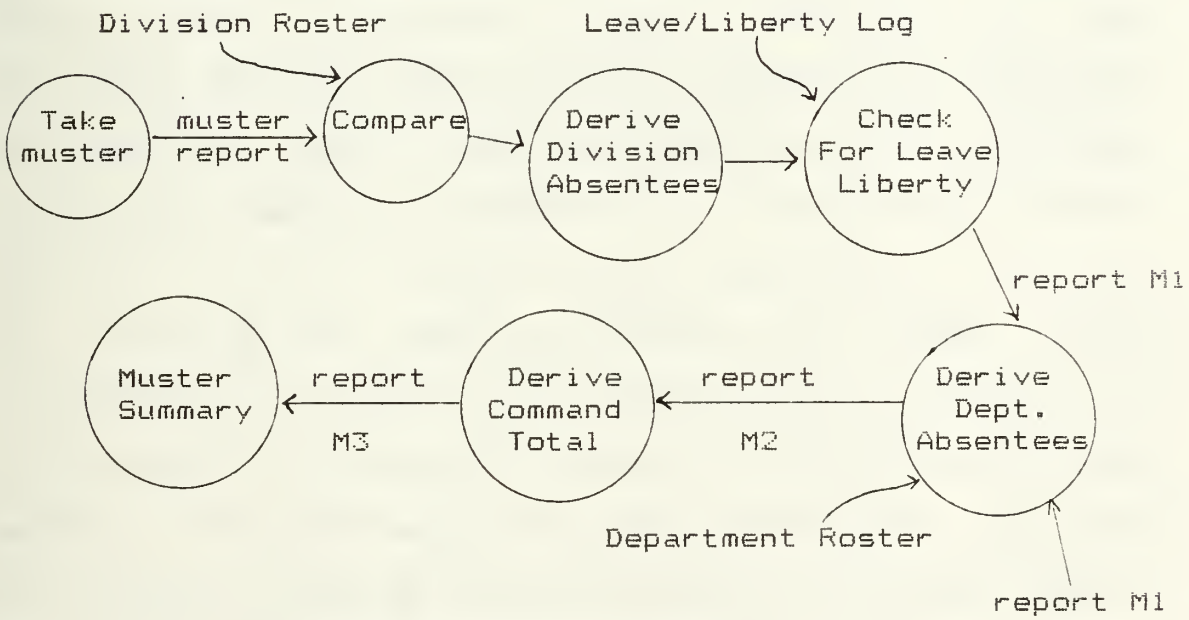
Current Logical DFD. Note that the derivation of report M1 is logically the same for the two divisions, therefore the logical data flow need only be mapped once on the Logical DFD. The Current Physical DFD views the physical data flow, while the Current Logical DFD views the processing that is undertaken or logical data flow.

After the analysis is completed and the two "current" DFD's are detailed, the analyst will graph the New Logical DFD. This will describe an improved processing design. A data dictionary is derived showing partitioning and interfaces. A data dictionary is simply what its name implies, a listing of data names, data characteristics, and who controls or owns the data. For example, the division muster report may be listed in the data dictionary as "muster", "muster" containing last name, first name, social security number, division, and rotation date of each man. Each of these data elements would be further defined; e.g., rotation date might be specified as year, month, and day, each 2 digits long (e.g. "851201").

After completing the New Logical DFD and data dictionary, the New Physical DFD will be derived. This is where the new computerized system will be integrated to form an Organizational Support System. In our command muster example, a computer might perform all tasks between the muster report and CDR Wise, such that Chief Pace and Chief Coffee enter the report on a terminal, the computer



Current Physical Data Flow Diagram



Current Logical Data Flow Diagram

Figure 2.3 Current Physical/Logical DFD

processes the data, and the Commanding Officer receives the report immediately on a terminal.

The concept underlying DFD is based on the top-down approach [Ref. 9:p. 22]. The diagrams represent a graphical hierarchy of data flow within the organization, as its name implies. The Current Physical DFD and Current Logical DFD allow management to relate organizational structure to activities, as well as relate physical data flow to logical data flow. The main advantage of DFD is its simplicity.

There are several disadvantages however. DFD does not display information controls, i.e., conditions or loops. Referring to the command muster example, who or what will insure the Commanding Officer receives the report by 0830? Obviously, there is pressure on all involved personnel to meet this deadline, however DFD does not depict these controls or the feedback loops to insure that the tasks are completed in accordance with policy. Also, DFD does not describe priorities to activities, inputs or outputs. Referring to the command muster example, must all division muster reports be received by LCDR Cash prior to his submission of the department's muster report (report M2) to Petty Officer Trim? Is there a priority or preference by LCDR Cash as to which division muster report he receives first? Another shortcoming of DFD is that the degree of decomposition to be executed is never defined; i.e., how many hierarchical layers are necessary? In this simple

muster example, the one layer is sufficient for the command's purposes. However, for a Fleet Command Muster system, other hierarchical layers would be required above the command muster report layer. A final deficiency of DFD, is that the products are not adaptible to computer aided supports.

F. STRUCTURED ANALYSIS AND DESIGN TECHNIQUE (SADT)

Like DFD, SADT is categorized as a datalogical model. SADT was developed by SOFTECH [Ref. 12, 13]. The methodology employs a common language between the analysts and the design engineers. Like DFD, SADT is a graphical approach, however SADT includes concise supporting text with the sequence of diagrams.

> "Boxes represent parts of a whole in a precise manner. Arrows represent interfaces between parts. Diagrams represent wholes and are composed of boxes, arrows, natural language names and certain other notations. The same graphics are applicable to both activities and data" [Ref. 12:p. 11].

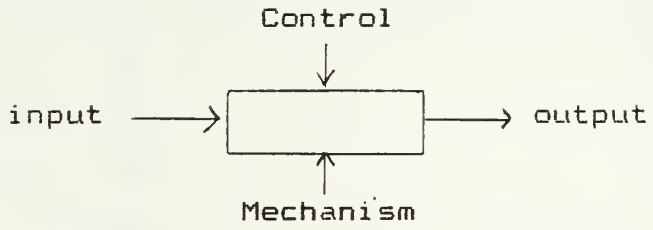
Boxes display input, output, and control of data (datagram) or a process (actigram). For a datagram, the incoming or leaving arrows detail the processes providing or using data within the box. For an actigram, the arrows connecting a box structure would detail the data needed or provided by the process inside the box.

Like DFD, SADT produces a top-down hierarchical decomposition. However unlike DFD, SADT allows control

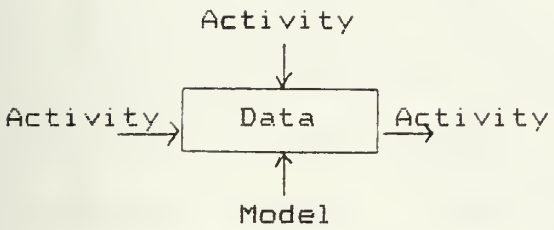
mechanisms to be graphed. The SADT box is detailed in Figure 2.4, with actigram and datagram examples [Ref. 13:p. 25]. The SADT product is a series of diagrams resembling blueprints, with supporting text.

Figure 2.5 would be an actigram of the command muster report. Lower hierarchical layers would need to be developed. In effect, the analyst would explode each of the boxes in Figure 2.5 to detail the next lower level. Each of those boxes could then in turn be exploded to detail the next lower layer, and so on. Working upwards from the Figure 2.5 layer, layers would be developed until eventually the command mission(s) are depicted. The mission of the command, the top level of the hierarchy, would describe the function of the command. Figure 2.5, Command Muster Report, does not describe the function of the command; Figure 2.5 is only one task or process of many that will contribute to the overall mission of the command.

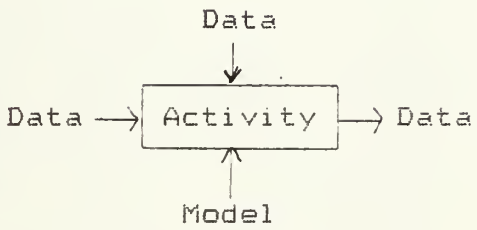
Like DFD, SADT is a top-down approach to analysis [Ref. 12:p. 11], and develops a datalogical model. Also, SADT allows management to relate activities to the organizational structure (through the upwards pointing arrow of an actigram) and describes physical and logical data flows (by connecting actigrams with arrows, both flows are depicted). The main improvement of SADT over DFD is that controls to activities can be depicted.



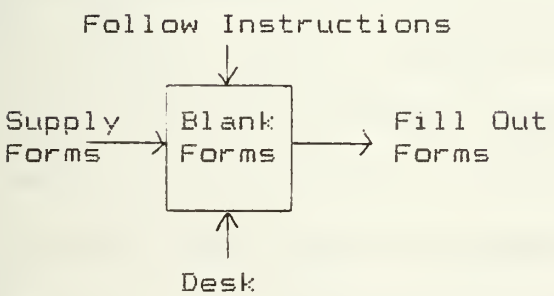
Basic Box Structure



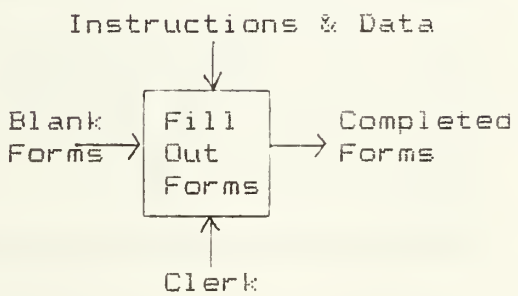
Datagram



Actigram



Datagram Example



Actigram Example

[Ref. 13:p. 25]

Figure 2.4 SADT Datagram/Actigram Structures

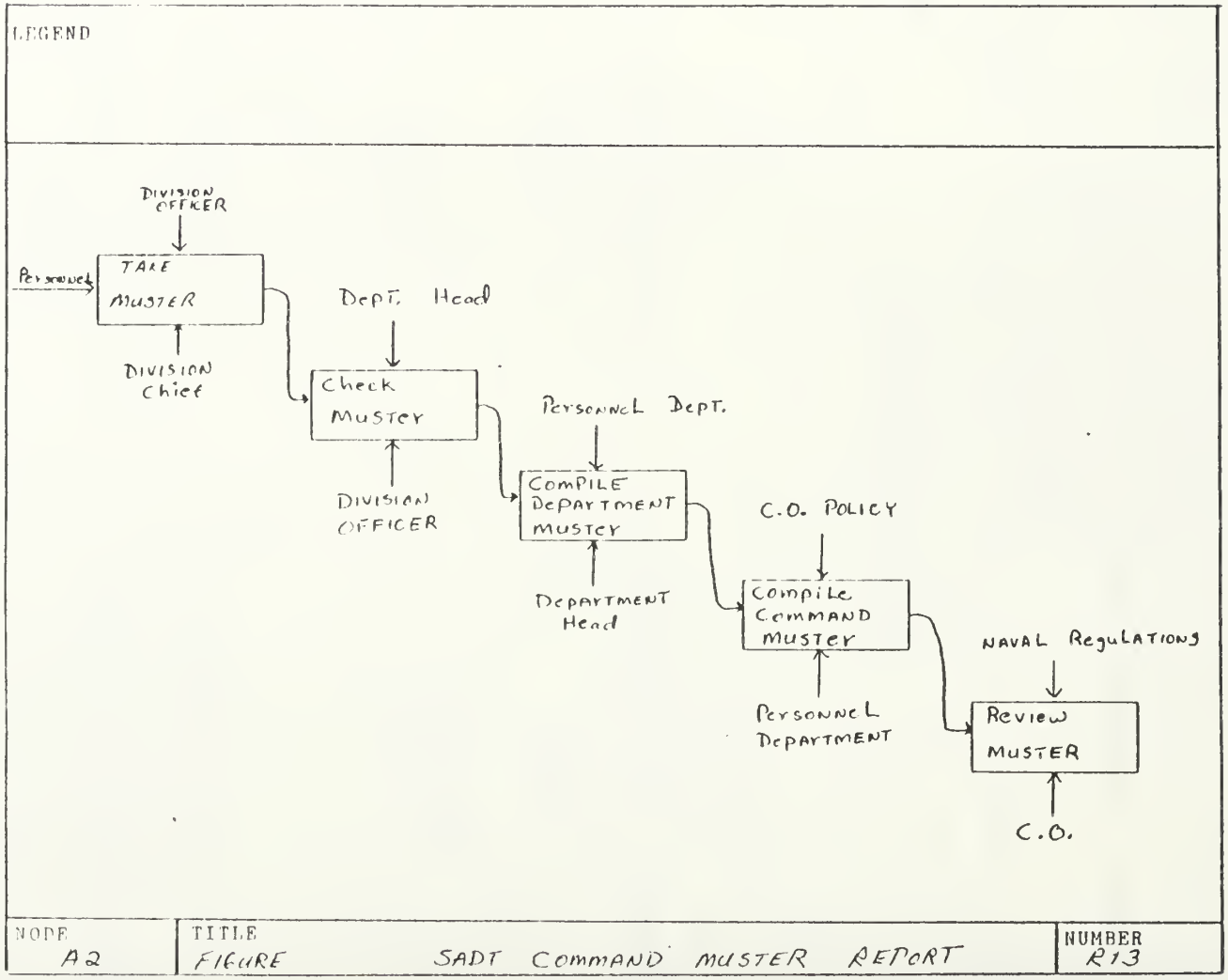


Figure 2.5 SADT Connand Muster Report

However, there are some deficiencies with SADT. SADT cannot represent priorities to the controls, therefore the model cannot prioritize activities, input or output. Also, SADT does not indicate how far to continue the decomposition. Because SADT requires supporting text, the model does not lend itself entirely to computer tools such as PSL/PSA (Problem Statement Language/Problem Statement Analyzer).

G. SYSTEMATIC ACTIVITY MODELING METHOD (SAMM)

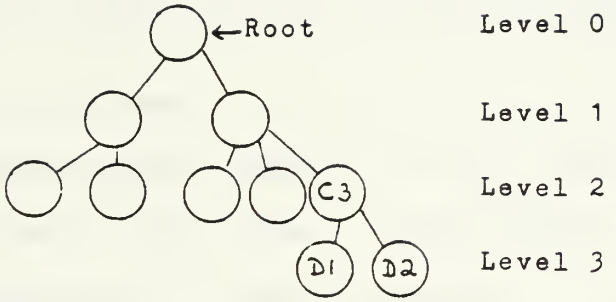
Developed by Boeing Computer Services Company, SAMM is similar to the SADT method. Like DFD and SADT, SAMM is a datalogical model, which uses a top-down approach to analysis [Ref. 10:p.101]. The SAMM model has three elements: a Tree Structure which describes the context of a diagram in a system; an Activity Diagram which describes the activity-data flow relationships of a system; and a Condition Chart which documents the functional behavior of a diagram [Ref. 10]. These three elements of SAMM divide the role of SADT diagrams into different mediums, making the organization easier to understand. In SADT, only the diagram language is defined and supporting text is required. SAMM however defines the language or format using the three elements. Thus SAMM offers a more structured product, which is adaptable to computer aids.

Figure 2.6 is a SAMM model of the command muster report. The Tree Structure consists of nodes branching out from a

root node. The nodes represent activities; i.e., any action performed by a machine, people, or combination of both to accomplish an organizational task. In Figure 2.6, nodes D1/D2 are the division musters feeding into node C3 to complete the muster task. The root node represents the mission(s) of the command. All other nodes represent activities that support the root node.

Each node of a tree is further refined by an Activity Diagram. The Activity Diagram consists of two parts. One section describes the subactivities through activity cells and data flows, in a manner similar to DFD diagrams. The other section of the Activity Diagram consists of a data table. Data elements are listed and numbered; numbers of data elements are placed appropriately in the data flow of the subactivity diagram. Figure 2.6 shows the Activity Diagram for nodes D1/D2, which describe generation of the division muster reports.

For each Activity Diagram, a Condition Chart is developed. The Condition Chart lists the input requirements for each output, and any special conditions that may apply. Thus, processing controls and prioritization to activities can be depicted. Figure 2.6 shows the Condition Chart for the only output of the Activity Diagram at nodes D1/D2, Division Muster Report. Condition 2 sets a time objective for the divisions in order to comply with the command policy

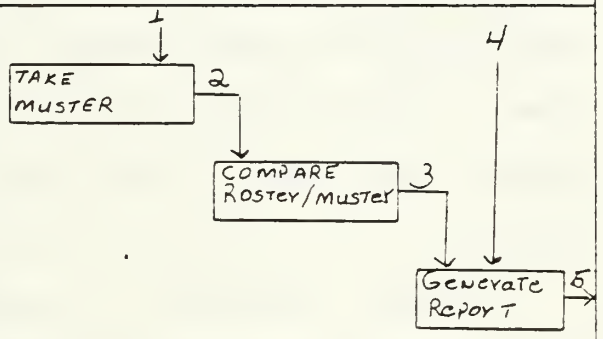


Tree Structure

Title Division Muster Node D1/D2

Data Description

1	Division Roster
2	Completed Div. Muster
3	Deviations
4	Leave/Liberty Log
5	Division Muster Report



Activity Diagram

Title Division Muster Report Node D1/D2

output	input req'd	Cond. code	Condition Description
2	1	1	1 Process Completed Successfully
3	1,2	1	2 Task to be completed by time 0810
5	1,2,4	1,2	

Condition Chart

Figure 2.6 SAMM Model of Division Muster Report

that the command muster report reach the Commanding Officer by 0830.

SAMM is primarily a computerized model. With the appropriate software, commands such as "Add Cell", "Insert Cell", "Delete Cell", etc. will generate the model. After consistency checking (syntax of fields) and connectivity analysis (insuring graphs are connected and accessible through a node), various computer assisted control activities can be performed. For example, a data refinement tree report traces a data item from the top through various layers to insure that data decomposition was specified correctly.

Another advantage of SAMM is that the organization structure can partially be related to the Tree Structure. For example, Level 0 would represent decisions by the top management level, the Commanding Officer. However, the activity at node C3 is conducted by Petty Officer Trim, who is junior to the department head, the division officers, and division chiefs; in this case, the Tree Structure does not relate well to the organizational structure. With SAMM, activities are not labeled with a person or organizational position, unlike with DFD or SADT.

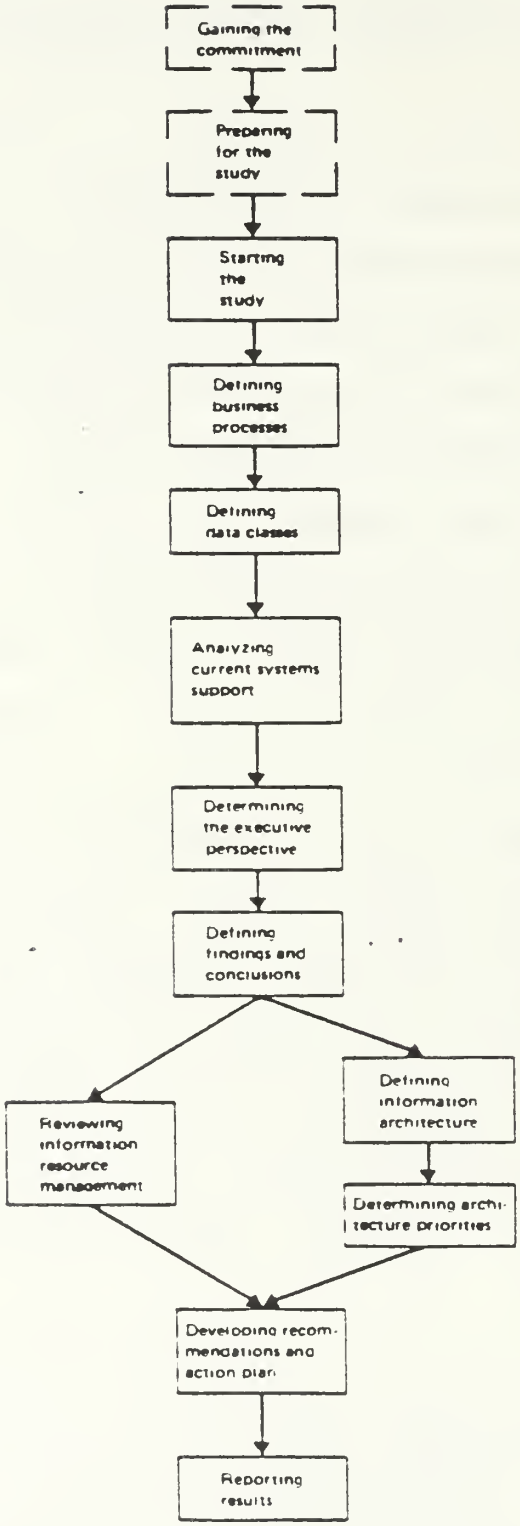
Even with all of these advantages, SAMM does have some limitations. SAMM can prioritize activities, however it cannot prioritize inputs or outputs to the activities [Ref. 10:p. 108]. As with all of the methodologies discussed,

SAMM does not define how far organizational decomposition should go.

H. BUSINESS SYSTEMS PLANNING (BSP)

BSP was developed by IBM and is a structured approach to assist an organization in establishing an information systems plan [Ref. 14]. BSP produces an infological model. It is a formalized method where users participate extensively in identifying their own organizational objectives and then translate them into information needs. present and future, with the aid of professional systems analysts. The method is logical, comprehensive, using top-down approach to analysis, bottom-up approach to implementation (i.e., implementing the system at the lower organizational levels first, then implementing upwards through the organization). Because the users will do most of the leg work, the key to a successful BSP study is getting organizational personnel committed and involved. The upshot of this requirement, is that data becomes recognized as a corporate resource, used for strategic and operational decisions.

Figure 2.7 lists the steps of the BSP analysis [Ref. 14:p. 13]. Gaining the commitment is the keystone to a BSP study; if organizational commitment is lacking, the study should be abandoned. To gain the necessary commitment, the strategy is to work with top managment and develop reasons for the study. Once a set of study objectives are defined,



[Ref. 14:p. 13]

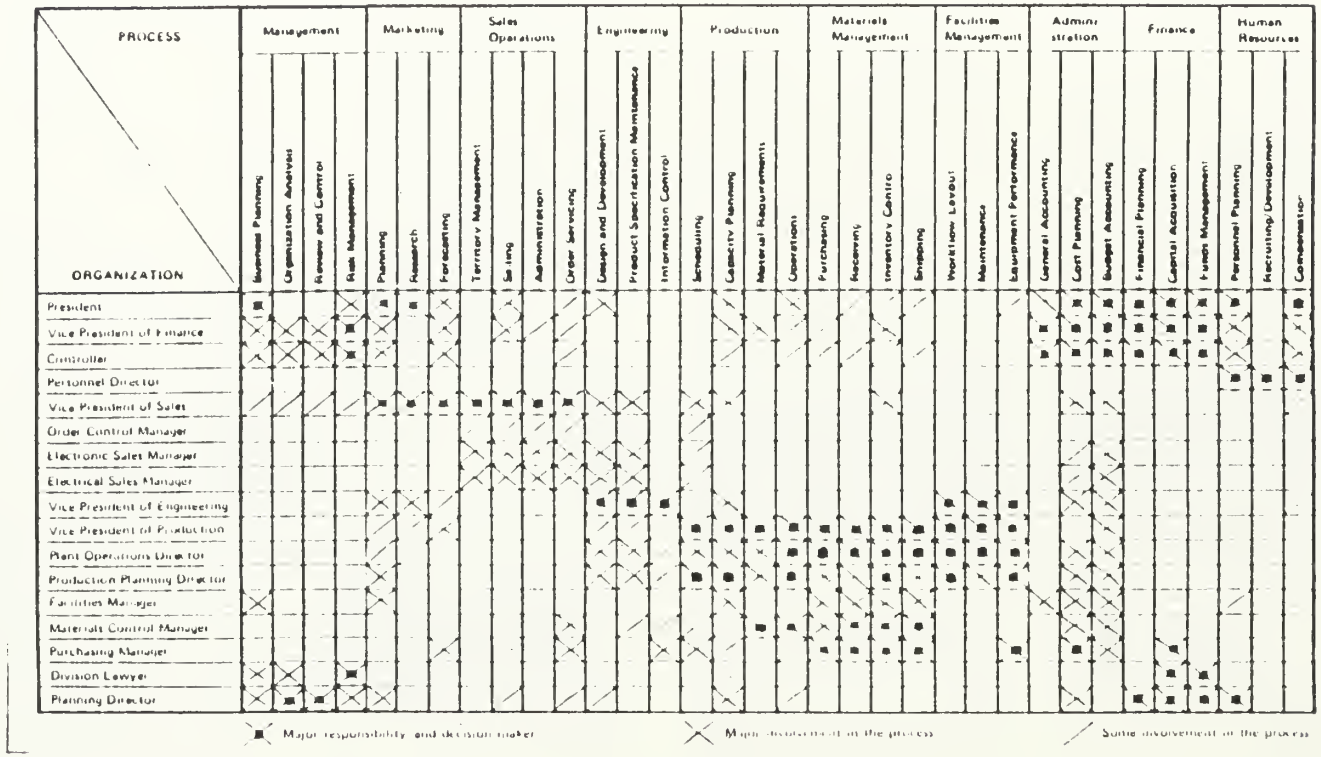
Figure 2.7 BSP Study Flow

top managment can motivate their subordinates. Thus, the commitment ideally works its way down through the organization. Experienced organizational personnel are selected to conduct the study, with professional advisors. In this way, the results will reflect what the organization perceives as its information needs and priorities. Guidelines for study preparation and gaining organizational support as a whole are described in the method.

The next step, Defining Business Processes, seeks to identify the major organizational activities and the personnel involved. A process and organizational matrix is defined (Figure 2.8) [Ref. 14:p. 38]. This matrix describes who the management decision makers are for specific activities.

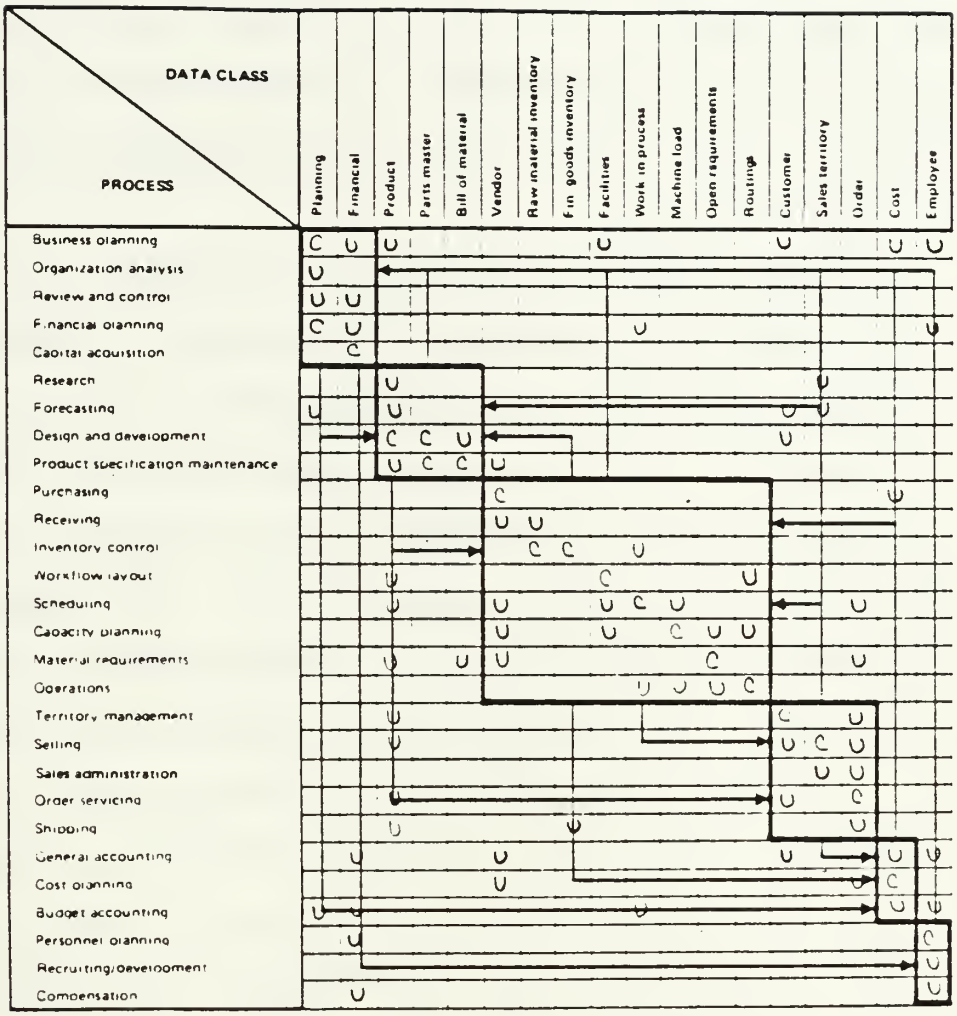
From the activities, input and output data classes are detailed. The activities and data classes are related in a Process and Data Class Matrix. The relation can be one of three types. The first relation type is creation (C), where the activity creates the data class; e.g., a division muster report is created by a division chief during a division muster activity. The second relation can be usage (U), where the activity uses the data class; e.g., a personnel department yeoman uses the division muster reports in the command muster activity. The third relation is no involvement (blank); e.g., a division muster activity does

REPRODUCED AT GOVERNMENT EXPENSE



[Ref. 14:p. 38]

Figure 2.8 Process/Organizational Matrix



[Ref. 14:p. 72]

Figure 2.9 Process and Data Class Matrix

not use the data obtained from a command muster report. Once all of the relations are labeled, the Process and Data Class Matrix is rearranged by moving data class columns so that groupings of "C's" and "U's" begin at the upper left, and move to the lower right. This has been accomplished in Figure 2.9 [Ref. 14:p. 72], where process and data groups have been identified.

The reader may be wondering at this point, what does all of this labeling relationships and column juggling, in order to obtain groupings, get an organization? The groupings can be related to organizational personnel and structure. That is, data classes (and therefore data elements) are grouped into proper parts of the organization. For example, in a squadron, aircraft maintenance records should remain under the control of the maintenance department, since they create and use these records; it would be ridiculous to put these records under the control of the administration department, since they do not even use these records. This is a simple example, transparent to the reader. A more difficult example would be, how do we allocate a listing of command personnel? All departments use this data, however personnel from the administration department will normally be the people that create and use this data. A BSP study would show the organization the logical way they deal with data classes (i.e. information), and groupings that would reflect major activities of information handling.

Thus, the BSP method yields information flow within an organization, displaying relationships to subsystems (e.g. aircraft maintenance) and the processes supported by each subsystem (e.g. operation's department flight schedules are supported by the aircraft maintenance accomplished in the maintenance department). From these results, information resource decisions can be made. That is, decisions concerning subsystems to receive computer support and development priorities of the computer subsystems can be made. Current computer equipment is taken into account when generating the development plan.

BSP does not provide a language for a system analyst to perform detailed system design. Rather, it furnishes a comprehensive methodology for understanding processes of an organization in terms of information needs. Reviewing the Waterfall Model (Figure 1.1), a BSP study supplies a major contribution towards completing the System Feasibility phase.

Turning to the attributes of this discussion, BSP uses a top-down approach to analysis that develops an infological model. From the model, information (i.e. data classes) can be related to the organizational structure. The model describes both physical and logical data flow, however the vantage is from groupings of major activities; i.e., a macro view. BSP does not represent information controls, only ownership and usage of information. Prioritization of

activities, input or output are not addressed at all. BSP does not define at what point the decomposition is complete; i.e., the analytical extent to effectuate in determining processes and data classes is never defined. Like DFD, BSP has no computer support and is strictly a manual process.

I. BUSINESS INFORMATION ANALYSIS AND INTEGRATION TECHNIQUE (BIAIT)

BIAIT is a methodology which attempts to simplify the Requirements Analysis and bridges the manager and data processing worlds [Ref.15]. BIAIT, like BSP, produces an infological model based on a top-down analysis approach.

The technique involves interviewing organizational personnel and obtaining answers to seven specific questions. Table I shows a sample question table [Ref. 15:p. 6]. The question set is related to the organizational level; Enterprise/Establishment, Department, or Occupation. Answers to the questions are "on" or "off" type (e.g. yes or no), so that the interview results can be easily processed by a computer.

The BIAIT method "points directly toward who the data owners and data users should be" [Ref. 15:p. 8]. Because of the ease of use of the questionnaire required in the interviews, the method is fast. However, the orientation of BIAIT is slanted towards defining a transaction processing system or perhaps a simple management information system [Ref. 5].

TABLE I - BIAIT QUESTION TABLE

[Ref. 15:p. 6]

Supplier Questions → / Organization Level ↓	Billing?	Deliver Later?	Profile Customers?	Negotiate Price?
Enterprise/ Establishment	bill or take cash	later or now	record previous orders from source or no profile	negotiate or fixed
Department	cost center or budget	plan work or fire call	record previous orders from source or no profile	costed work order or standard rate
Occupation	commis- sion or salary / piece work or hourly wage	self- sched- uled or prior- ity set by others	record previous orders from source or not profile	costed work order or standard rate

Ordered Entity Questions → / Organization level ↓	Rented?	Tracked?	Made to Order
Enterprise/ Establishment	rented or sold	record who received or no record	made/assembled to order or from stock
Department	loaned or given	record who received or no record	assemble/create or provide from files
Occupation	loaned or given	record who received or no record	assemble/create or provide from files

Like BSP, the BIAIT model does not address controls to information, priorities to activities, or priorities to input or output. The BIAIT model provides an implicit understanding of the organizational structure to the activities. The understanding is limited, since the analyst must predetermine the question category of each person in the organization. This consequence also makes the understanding of the physical and logical data flows somewhat difficult to comprehend. Additionally, BIAIT does not define at what point the analysis is completed.

J. CRITICAL SUCCESS FACTORS (CSF)

CSF is an infological methodology developed at MIT which concentrates on "helping executives to define their significant information needs" [Ref. 16:p. 84]. These information needs are recognized to be individual, specific, and to change over time.

Through interviews of individual managers, a set of critical factors that determine success for the organization are defined. Generally, three to six CSF's are determined. For example, critical success factors for a naval base Commanding Officer might be:

1. Budget management.
2. Facilities maintenance and improvements.
3. Responsive procurement in accordance with tenant demands.

4. Improve public relations within the surrounding community.

5. Obtain authorization and funding for construction of family housing units.

Once critical success factors are defined, systems are determined that will support each manager.

An actual procedure is not defined in Rockart's paper [Ref. 16]. The biggest difference between CSF and the other infological methods, is that CSF attempts to influence the manager's decision making process; BSP and BIAIT merely try to understand a manager's decision process. The importance in determining critical success factors for the organization as a whole cannot be overstated. However, CSF's for a middle manager may not be in line with the CSF's for upper management. The analyst must somehow resolve such conflicts, and support all manager's CSF's.

Turning to the attributes of this discussion, CSF is a top-down approach to analysis which produces an infological model [Ref. 5]. CSF does not relate activities to the organizational structure; the CSF's are a manager's criteria for success, which are never related to personnel or activities that will accomplish the CSF's. Therefore, CSF does not even address physical or logical data flows. Like all of the infological models discussed, a CSF model does not represent controls, activity priorities, or priorities to input or output. As with all of the models discussed, CSF never defines at what point the analysis is

completed. The CSF model is not adaptible to computer supports.

K. SUMMARY OF MODELS/CHOOSING A MODEL

The preceeding discussion of Requirements Analysis methodologies, has given the reader a general understanding of the different approaches, their particular strengths and weaknesses, and a feeling for the difficulties of the process.

The datalogical models (i.e. DFD, SADT, and SAMM) provide a detailed view of each process or task, such that design engineers can design the Organizational Support System. On the other hand, the datalogical models contain such a microscopic view of the organization, that top management has a difficult time participating in the information resource decisions; i.e., the "big picture" is somewhat obscure to top management simply due to the mass of detail.

The infological models (i.e. BSP, BIAIT, and CSF) concentrate on the "big picture" or macro view, such that the exact details of how a system will accomplish the processes and tasks are not defined. Top management participates in information resource decisions, however details are not provided so that the design engineers are unable to translate the requirements into an Organizational Support System.

TABLE II - COMPARISON TABLE OF REQUIREMENTS ANALYSIS METHODOLOGIES

Attribute	DFD	SADT	SAMM	BSP	BIAIT	CSF
Top-down approach	yes	yes	yes	yes	yes	yes
Datalogical	yes	yes	yes	no	no	no
Infological	no	no	no	yes	yes	yes
Relate to Org. Structure	yes	yes	yes	yes	implicit	no
Relates Physical to Logical Data Flow	yes	yes	yes	macro only	some	no
Represent Controls	no	yes	yes	no	no	no
Prioritize Activities	no	no	yes	no	no	no
" Input/Output	←		NO			→
Decomposition extent Defined	←		NO			→
Computer Adaptible	no	some	yes	no	yes	no

Table II summarizes the attributes of the methodologies discussed.

Traditional life cycle development would use an infological model followed by a datalogical model to design the system. This is a time consuming but necessary process.

By designing a prototype architecture based on one complete Requirements Analysis, the overall development effort can be considerably decreased. Such is the case with the Bases and Stations Architecture.

This is not to imply that a Requirements Analysis should not be done at other naval stations. In order to shape the prototype to fit the needs of each naval base, some degree of analysis must be done.

In order to tailor the Requirements Analysis to shape the prototype, it is useful to list what the analysis should do. The following is a list of requirements that the author developed.

1. The Requirements Analysis should describe the information structure of the organization. This description should allow the command to decide which prototype modules are desirable and ascertain how they will plug in; i.e., physical and logical data flows need to be depicted. By implementing the prototype architecture, implications for the organizational structure should be understandable to the users.

2. The Requirements Analysis description should include current Automatic Data Processing (ADP) resources, so that command decisions to replace current hardware can be kept to a minimum. This will insure implementation costs are minimized.

The first requirement describes a method that is both datalogical and infological. The second requirement describes an infological method. Turning to Table II, the model should perform a top-down analysis, should relate to the organizational structure, and should relate the physical and logical data flows, at the macro and detailed levels.

The BSP Process and Organization Matrix will satisfy requirement (2) and will provide the command with a grand view of the information structure. A datalogical model is needed to complement the BSP results so that requirement (1) can be satisfied. DFD, SADT, or SAMM will all do the job. A complete organization decomposition is not required, only a decomposition from mission(s) down to functional levels. Since a better appreciation of the functional relationships

can be understood by depicting data flow controls,DFD should be eliminated. Since the model is to be developed primarily for use by the command, the model must be understandable to those unfamiliar with the technique or ADP. Both SADT or SAMM do this, however SAMM requires the user to reference several elements (i.e. Tree, Activity Diagram, and Condition Chart). Although SAMM is a more complete model, as discussed previously, the author feels that the extra detail is not necessary in this instance. Therefore, the author selected SADT for the datalogical model.

Having discussed the rationale for the necessary models to define the Bases and Stations prototype, the proposed methodology will be further discussed in Chapter 3.

The success of an analysis will ultimately depend on how the analyst gathers data to develop the model. As John Von Neumann said,

> "There's no sense being precise about something, when you don't even know what you're talking about" [Ref. 7: p. 157].

L. DATA COLLECTION TECHNIQUES

So far this research has confined data collection elements to input-output-control features of a system in order to create a model. In a traditional life cycle, there are other data elements that need to be considered prior to system design. Grayce Booth lists data elements which must be collected [Ref. 17:pp. 35-36].

1. The prospective users of the system.

2. The information needs of those users; i.e. the types of output and output schedules required.

3. How the system will be used (i.e. interactive, batch, etc.).

4. The processing required to produce the defined outputs.

5. The geographic range of the system; where the users are located and locations where computing equipment can be installed.

6. The data to be stored by the system.

7. Requirements for system integrity, security, privacy, and auditability.

8. Types of change and/or expansion likely to be needed; the degree of flexibility required.

9. The management-control philosophy of the organization; i.e. centralized or decentralized.

It is worth comparing this list against the Requirements Analysis models the author has selected for this study (i.e., the BSP Process and Organization Matrix and SADT diagrams). The users of the system, the information needs of users, the required processing, the data to be stored, and the required flexibility (elements 1,2,4,6 and 8 respectively) will all be addressed using the selected models and techniques. Of the remaining elements, how the system will be used, integrity, security, privacy, and auditability requirements, and management-control philosophy should be predefined in developing the prototype (elements 3,7, and 9 respectively). However, these elements should be reviewed by each naval station to insure the prototype

definition conforms to each naval station's requirements. Additionally, the geographic range of the system (element 5) will need to be defined by each naval station. The methodology suggested by this thesis will consider all of these elements to some degree. This list of elements could serve as a final checklist to review the Requirements Analysis products.

At this point, the reader may wonder how the analyst collects the data to formulate the Requirements Analysis model(s). Senn [Ref.8:pp. 375-379] describes five techniques for collecting data so that the analysis can be accomplished. These are interview, questionnaire, observation, document examination, and measurement (often called sampling).

The interview is a "specialized pattern of verbal communication - initiated for a specific purpose and focused on some specific content area, with consequent elimination of extraneous material" [Ref. 18:p. 16]. The interviewer must be aware of the pitfalls of the technique; i.e. motivation barriers, psychological barriers, and language difficulties [Ref. 18]. Particularly for a Requirements Analysis, the analyst must avoid regressing into computer jargon [Ref. 17:p. 38].

Motivating the respondent is one of the keys to successful interviewing. The interviewer should motivate the respondent intrinsically and extrinsically. Intrinsic

motivation is done by allowing the respondent to feel personal gratification during the communication process; i.e., allow the respondent to enjoy the conversation. Extrinsic motivation is done by communicating the following [Ref. 18:pp. 80-81]:

1. Purpose of the interview - relate to respondent's goals and values.
2. The ways in which the information the respondent contributes is to be used and to whom it will be available to.
3. In a general way, what is expected of the respondent in the course of the interview; i.e., factual information, attitude/feelings, etc.

The interviewer must convince the respondent that they both have some overlap of knowledge in the area under discussion and that the interviewer respects the respondent's ability to provide the information needed. Additionally, the respondent must feel that he/she is free to express himself/herself without fear of being judged by the interviewer.

The questionnaire is particularly effective when many people must be polled. Considerable care must be taken in the design of the questions so that meaningful results are obtained. For example, if an analyst needed to determine the managers in the muster report process, a question like "Are you involved in the muster process" will result in poor results. All command personnel are "involved" in the muster process, in that they must present themselves for muster.

The question needs to be reworded; e.g., "Do you take or check muster reports"? A significant weakness of questionnaires is that they do not allow probing of respondent replies.

Observation is particularly useful for obtaining information about repetitive tasks; e.g., a supply transaction data flow. It must be recognized that people under observation frequently exhibit different behavior than under normal conditions. This phenomenon is known as the Hawthorne effect [Ref. 8:p. 377]. One way to counteract a biased observation due to the Hawthorne effect, is for the observer to conduct the observations from a location not visible to the personnel being observed. For example, a camera can be set up so that the workers do not know when they are being observed, much like a camera security system in department stores. Eventually, workers become accustomed to the camera and resume normal behavior.

Document examination involves examination of reports, memoranda, instructions, etc. The analyst must recognize that what is indicated on paper may not be the actual way tasks are accomplished. To validate documented procedures, the analyst should supplement his/her findings with another technique, e.g. the interview.

Measurement (or sampling) is useful for obtaining generalized data; e.g., how many typing errors occur for a specific secretary based on measurement of two typed

letters. Depending on the sample chosen, the measurement may or may not reflect reality. Assuming the sample taken is truly random, the larger the sample taken, the more closely the average will approximate reality [Ref. 8:p.379].

Following the data collection, the analyst formulates the model. The model will describe the processing of information. The additional elements (e.g. security, privacy) must also be precisely described in a report. The combined collection of the models and reports will enable systems engineers to begin the design of the Organizational Support System.

III. A NAVAL INFORMATION SYSTEM METHODOLOGY (NISM)

A. METHODOLOGY

The rationale for the particular requirements analysis models of this thesis was briefly discussed in Chapter 2. The BSP Process and Organization Matrix and a SADT model will provide a command with the information to aid in decisions regarding the Bases and Stations Architecture. Additionally, these models will provide guidance to the implementors on just how to interface selected modules.

The methodology of this thesis is depicted on Figure 3.1. The methodology is a modified version of the BSP approach, depicted on Figure 2.7. An individual name is required for this methodology, since the technique will employ characteristics of BSP and SADT. The author has chosen the name Naval Information System Methodology (NISM), which briefly describes the function of the technique.

The NISM results will serve as a broad perspective for a naval base and aid in defining an Organizational Support System to meet information needs. The objective of an Organizational Support System is not to replicate the organization's tasks into a computer. The objective of an Organizational Support System is to support the organization's goals in a way that improves efficiency and effectiveness.

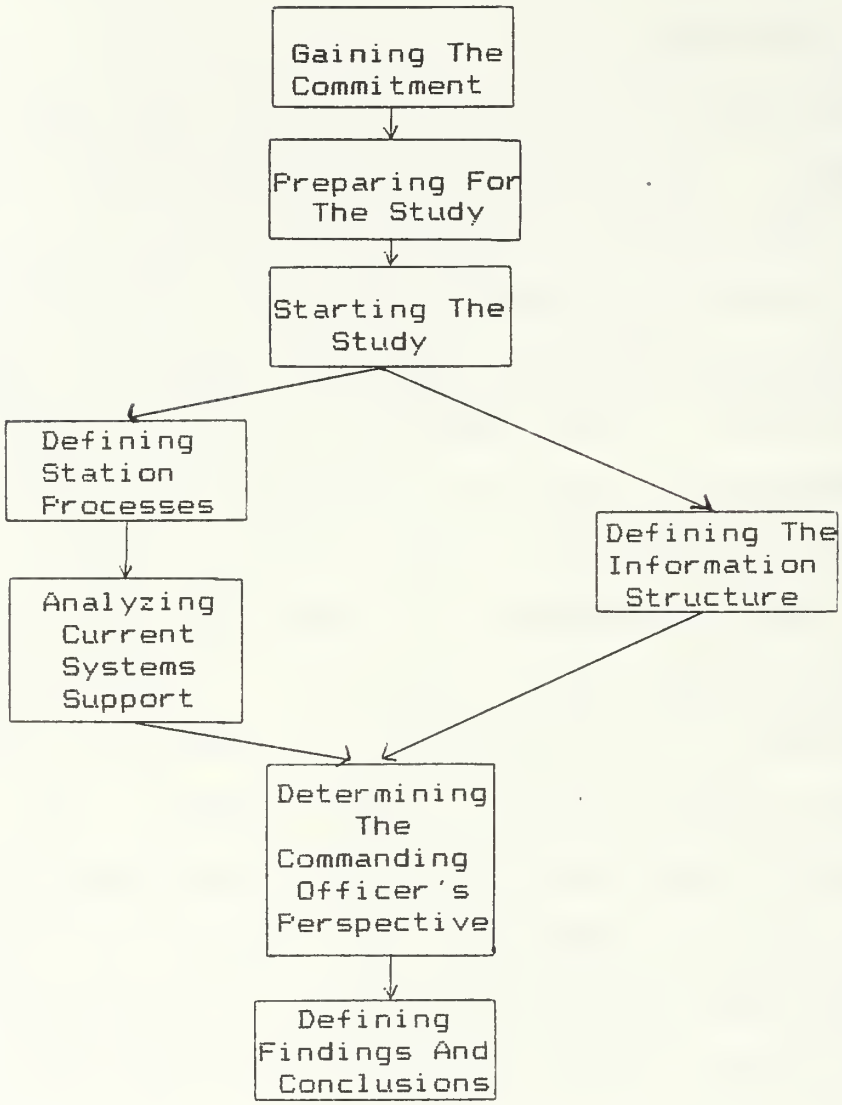


Figure 3.1 Naval Information System Methodology (NISM)

Peter Drucker defined efficiency as "doing things right" and effectiveness as "doing the right thing" [Ref. 19]. Thus, an Organizational Support System should improve the input-output features of operations (i.e. efficiency), as well as the ability to achieve defined objectives (i.e. effectiveness).

For an Organizational Support System to result in improved efficiency and effectiveness, computer power must be applied selectively. Not all tasks are amenable to improvements using computers. Both managers and analysts must play a role in the selection of where to apply computer power. NISM provides a medium that all users can understand and use with confidence. Interpretation differences can be resolved through discussion using a universal medium, i.e. the model.

The NISM results will also allow management to address organizational structural issues. Perhaps management may discover ways of reorganizing the structure that will result in better efficiencies. An organizational structure has evolved to meet its strategy, technology, and environment [Ref. 19:p. 224]. Management may find that their structure is not keeping pace with these factors. NISM will allow a base Commanding Officer and his/her department heads to take a fresh look at the present organizational structure so that they may scrutinize and perhaps detect changes that will improve the organization.

The remainder of this chapter will discuss the NISM technique. The author's study of the NAS Moffett Field, California will be used as an illustration. The study was completed in the Spring of 1985.

Appendix A is provided as a NISM checklist.

B. STEP 1: GAINING THE COMMITMENT

To insure accurate and comprehensive results of the study, commitment is essential. The base Commanding Officer must desire the study results. As mentioned previously, the results will aid a Commanding Officer in evaluating the organization structure and the information structure. Additionally, the models serve as a turnover item, which describe organizational interfaces, functional partitions, and ADP equipment; i.e., the models serve as a compact description of the nuts and bolts of mission fulfillment, which will aid the incoming Commanding Officer in understanding the organizational operations.

If the Commanding Officer supports the NISM study, the command personnel will also. The Commanding Officer should appoint a team leader to coordinate the study. Department heads should appoint department representatives. The team leader and departmental representatives will form the NISM board or team.

Departmental representatives should be selected based on their familiarity with the department's day to day operations. For example, a newly reported Ensign may not

have the departmental knowledge or departmental power to define the Supply Department at a large naval station like the NAS Moffett Field.

To insure appropriate departmental representatives are assigned by the department heads, the implications of the NISM results need to be communicated by the Commanding Officer and the team leader. These implications are:

1. The study results will be used by an external agency (i.e. NAVDAC, NARDAC, or NAVDAF) to develop a design, and implement a plan for the Bases and Stations prototype architecture.

2. The study will be used as the basis for the final design decisions by the Commanding Officer and NISM board. Knowledgable representation is a must for each department to profit from the effort.

3. The tailored prototype implementation will no doubt afford little justification for near-term ADP procurement requests from superiors.

4. The time for departmental ADP requirements is now. A knowledgable departmental representative can obtain the requirements in the package, or at least provide documentation for future reference; this documentation can be used as justification in future procurement requests.

Each departmental representative needs to be thoroughly briefed on his/her duties and role. The team leader needs to communicate this to all departmental representatives. Departmental representative duties include:

1. Representing his/her department in the shaping of the Bases and Stations prototype.

2. Representing his/her departmental ADP requirements, whether or not they are addressed specifically by the prototype. Documentation of all ADP needs should be accomplished as part of the NISM analysis.

3. Representing his/her department in the design and implementation plan prepared by the implementors (i.e., a team from NAVDAC, NARDAC, or NAVDAF).

4. Collecting information for the team leader so that the Process and Organization Matrix may be prepared.

5. Collecting information to diagram information flow within his/her department; i.e., departmental representatives will be responsible for preparing SADT diagrams for the department.

6. Providing feedback to the team leader as system implementation transpires. That is, system problems, training needs, etc. need to be coordinated centrally. Departmental representatives must monitor system implementation within their respective department and provide feedback to the team leader.

The team leader will coordinate the study effort. His/her job will be a full time occupation until some time after implementation. Whether the job is assigned to a civilian or military officer, it must be recognized that current duties will probably need to be curtailed. The primary duties of the team leader should be specified as pertaining to the NISM study and system implementation.

The Commanding Officer and department heads will also need to take an active role in the study. Study results need to be filtered through them so that accuracy and clarity is insured. Additionally, the top managers need to review the study for possible reorganizations of structure or information interfaces.

C. STEP 2: PREPARING FOR THE STUDY

Prior to generating the models, general information should be collected. The objective of this survey information is to condense the organization. Such a survey will provide the external agency that designs the system with a general understanding of missions, departmental interfaces, and organizational structure. Furthermore, the survey will allow each departmental representative (i.e. analyst) an opportunity to develop the skills and background for following NISM steps.

The NISM team will also require instruction and materials to conduct follow-on steps. For example, lectures will need to be scheduled on SADT procedures; blank SADT diagrams and handout instructions will need to be prepared. While NISM members develop analysis skills and prepare the general organizational surveys, the team leader will schedule lectures and prepare materials.

A list of facts need to be defined so that NISM members can focus their analysis. The author has prepared the following facts that need to be gathered.

1. Organizational Mission
2. Environmental Survey
3. Individual Department Surveys
    a. Department Mission
    b. Department Chain of Command
    c. Information Provided to the Commanding Officer

d. Information Provided to Other Departments

e. Information Required From Other Departments to Fulfill Mission

f. Current ADP Support

D. STEP 3: STARTING THE STUDY

Using the list developed in the previous step, data needs to be collected. Much of the information is general knowledge or information gathered from the command's organizational manual. Because of this, the NISM team may think that gathering this information is redundant work. However, this general information serves as a framework to build on and will also be used by the external agency that implements the Organizational Support System. Since the external agency is unfamiliar with a particular base's environment and mission, this framework will help the implementation team understand the naval base's organization.

The team leader should assign the responsibilities. The author believes the best way to allocate these assignments is for the departmental representatives to complete their respective departmental surveys. After receiving all departmental inputs, the team leader can complete the global surveys (Facts 1 and 2 above). The surveys should be concise and clear.

As an illustration, the author completed the survey for the NAS Moffett Field as described below.

1. Organizational Mission

"To operate and maintain facilities and provide services and material support operations to aviation activities and units as designated by the Chief of Naval Operations" [Ref. 20:p. 3].

"Facilities" include base buildings, including three extremely large hangars, base housing, grounds, station vehicles, civil engineering support equipment, airfield pavements, roads/streets/parking lots, steam plant, on-station utilities (sewage, water, electrical, heat, telephone, gas), departmental ADP hardware and software, etc.

"Aviation activities" includes several patrol aircraft squadrons (active duty and reserve), each with a complement of at least 9 P-3 Orion aircraft. Additionally, transient aircraft services and material support are provided.

"Units" includes Commander Patrol Wings Pacific (COMPATWINGSPAC), NALF Crows Landing, NASA Ames Research Center, NAVDAF Moffett Field, Marine Support Detachment, etc. NASA Ames Research Center receives contingency services only from the NAS Moffett Field; e.g. ambulance service, and collateral security forces.

2. Environmental Survey

The NAS Moffett Field, California is located in the Santa Clara valley in the city of Mountain View. The base

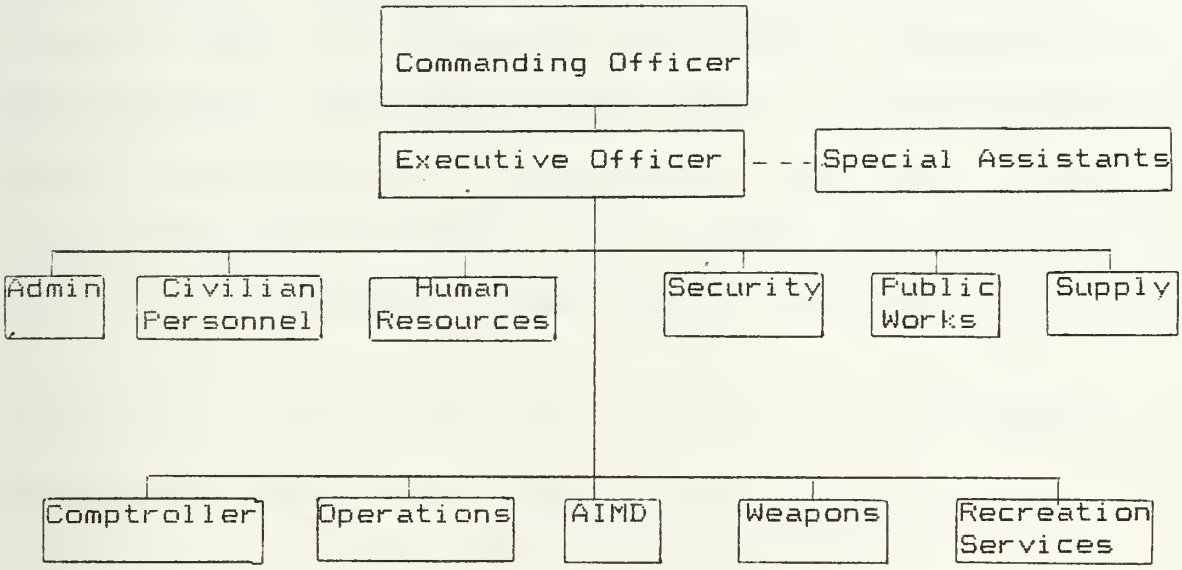
borders the southwestern edge of the San Francisco Bay. A pleasant, mild climate is present year round.

The computing power for the base consists of numerous vendor products with little interface between computer systems. Microcomputers and minicomputers are departmentally controlled. Procurement is centrally managed,the Commanding Officer has an ADP Coordinator on his staff (the billet is formally titled Management Analyst).

NAVDAF (Navy Data Automation Facility) Moffett Field, an echelon IV shore activity, is a client oriented, industrial funded organization whose personnel and equipment provide diversified automated data processing services to the NAS Moffett Field and its tenant activities. NAVDAF reports to the Commanding Officer, Navy Regional Data Automation Center (NARDAC) San Francisco, located at the NAS Alameda. The NAVDAF has a Burroughs B1955 mainframe (524 Kbytes) to accomplish batch jobs.

Moffett Field is the homeport of COMPATWINGSPAC and numerous VP squadrons. As such, Moffett Field serves as the most influential P-3 base in the Pacific theater. Therefore, P-3 aviation support becomes a significant concern for the base Commanding Officer and his department heads.

The NAS Moffett Field chain of command is diagrammed on Figure 3.2 [Ref. 20:pp. 7-9].



Special Assistants

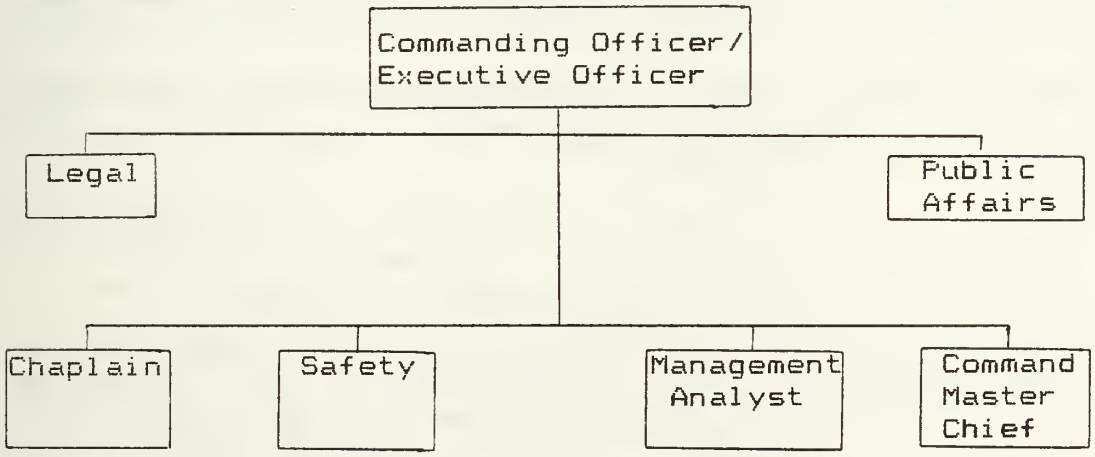


Figure 3.2 NAS Moffett Field Chain of Command

3. Individual Department Surveys

Facts to be obtained for individual departments would partially be obtained through interviews of the department heads. These interviews would probably be conducted by the NISM departmental representatives. The following general set of questions was developed to help steer the interviews with departmental managers.

1. Using the Organizational Manual as a guide, verify the mission.

2. Using the Organzational Manual as a guide, verify the departmental chain of command.

3. What general types of information do you supply regularly to the Commanding Officer (e.g., general correspondence for signature, progress reports, etc.)?

4. What general ad hoc query types does the Commanding Officer ask your department to provide him?

5. What general types of information does your department provide to other departments?

6. What general types of information does your department require from other departments to fulfill your department's mission?

7. What computer aids do you have in providing the Commanding Officer this information? Are they sufficient? If not, what else would you require?

8. Because of a lack of computers/personnel there may be information that could be provided to the Commanding Officer from your department that you are unable to obtain. Provided you had unlimited personnel and computing assets, is there any of this type of information that if you were the Commanding Officer you would like to see?

9. In your opinion, is there any information that your department will have to provide the Commanding Officer in the future?

The assigned interviewer, normally the department representative, should take notes and attempt to understand the department from the department head's vantage point. The department representative will require this scope during the next phases.

For the NAS Moffett Field, Departmental Mission and Chain of Command results are detailed on Figures 3.3 thru 3.13. Mission statements need to be concise and clear. At this point in the study, the objective is to condense the organization so that consolidated knowledge about the command and each department can be discerned.

E. STEP 4: DEFINING STATION PROCESSES

Defining Station Processes and Defining Information Structure steps can be done simultaneously. It is at this juncture where the real work begins for the NISM team. This section will concern itself with defining station processes; Section G will discuss the defining information structure.

> ". . . processes are defined as groups of logically related decisions and activities required to manage the resources of the business. They are studied and identified without regard to the organization responsible for them" [Ref. 14:p. 31].

Processes can be categorized as Planning and Control Processes, Product/Service Processes, and Supporting Resources Processes. By reviewing the previously developed

Administrative Department (Admin)

Mission: Provides general administrative services for the Command. This includes:

1. Operation of the centralized portion of activity mail, file, correspondence, directives, and messenger systems.

2. Development of policy/procedures and monitoring of compliance in the handling of classified material.

3. Management of specialized office equipment.

4. Manager of Air Station Forms.

5. Administers Restricted Personnel Program. [Ref. 20:p. 11]

Chain of Command [Ref. 20:p. 13]

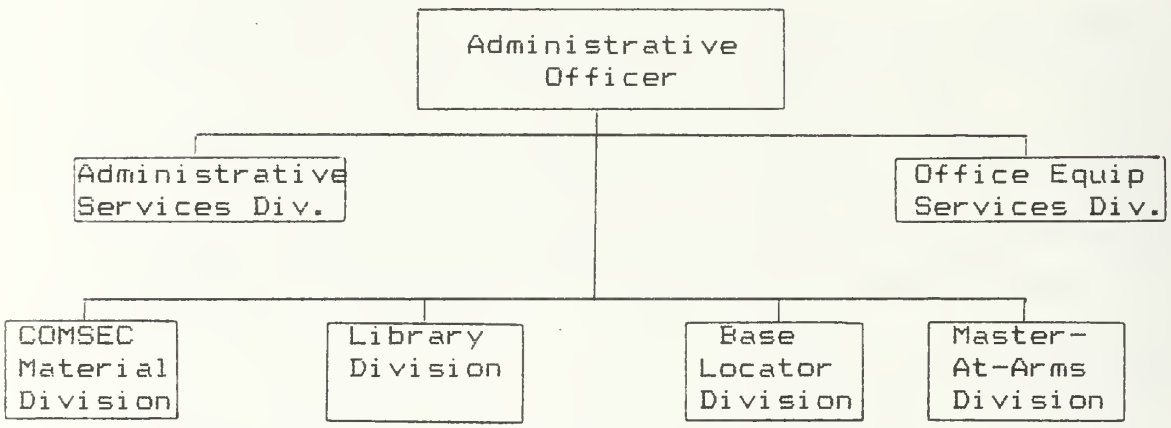


Figure 3.3 Administrative Department

Civilian Personnel Department (Civ Pers)

Mission: To provide management in all civilian personnel management programs and to assist the non-appropriated funds personnel management programs. [Ref. 20:p. 15]

Chain of Command [Ref. 20:p. 17]

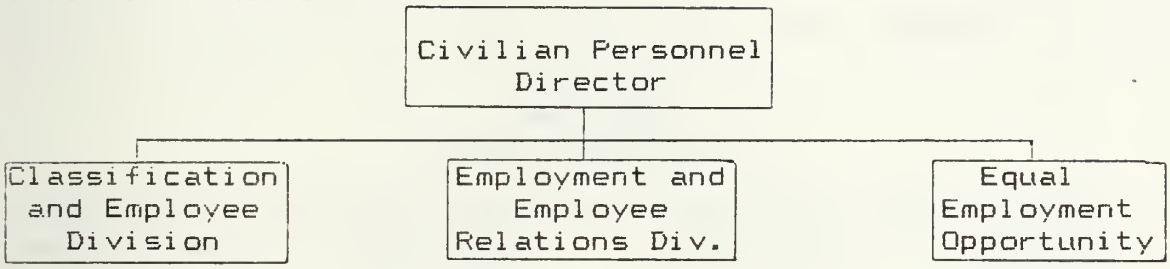


Figure 3.4 Civilian Personnel Department

Human Resources Management Department (Hum Res)

Mission: Responsible for administering the Human Resources Management Program. This includes supervising the Command Equal Opportunity Program, Command Action Plan, Affirmative Action Plan, Human Relations Council, Command Career Information Management Program, Family Service Center, Counseling and Assistance Center, Sponsor Program, Retired Affairs Office, Career Information and Counseling Schools, Casualty Assistance Calls Program, and the Personnel Support Detachment Liaison Office. [Ref. 20:p. 19]

Chain of Command [Ref. 20:p. 21]

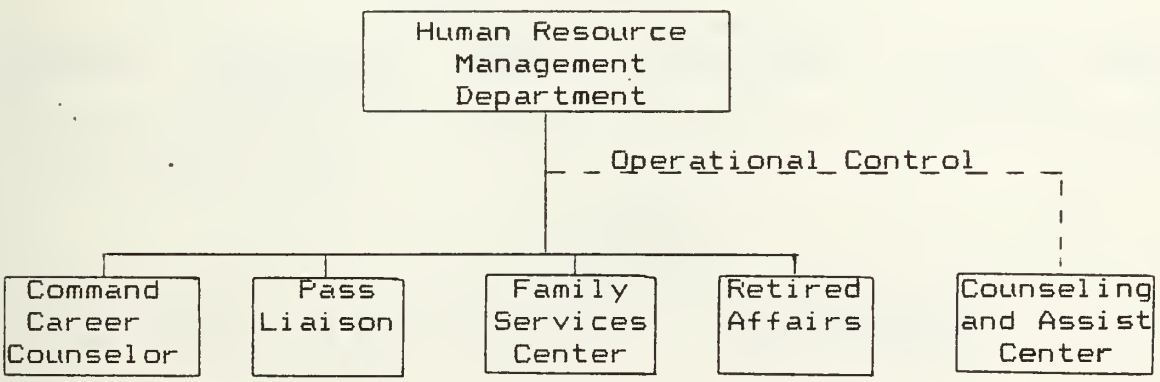


Figure 3.5 Human Resources Management Department

Security Department

Mission: Provides perimeter and internal security for the station. Investigates crimes and enforces station regulations. [Ref. 20:p. 23]

Chain of Command [Ref. 20:p. 25]

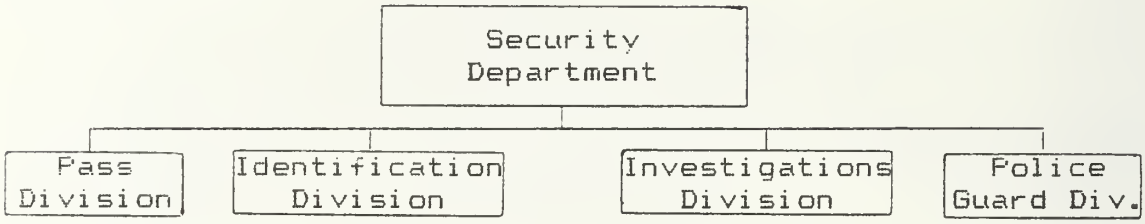


Figure 3.6 Security Department

Public Works Department (PW)

Mission: Operates, maintains, and repairs all station structures, grounds, roads, runways/taxiways, and utilities for NAS Moffett Field and NALF Crows Landing. Provides transportation and equipment vehicles. Administers the family housing program. Administers station energy conservation and environmental protection programs. [Ref.20: p. 27]

Chain of Command [Ref. 20:p. 33]

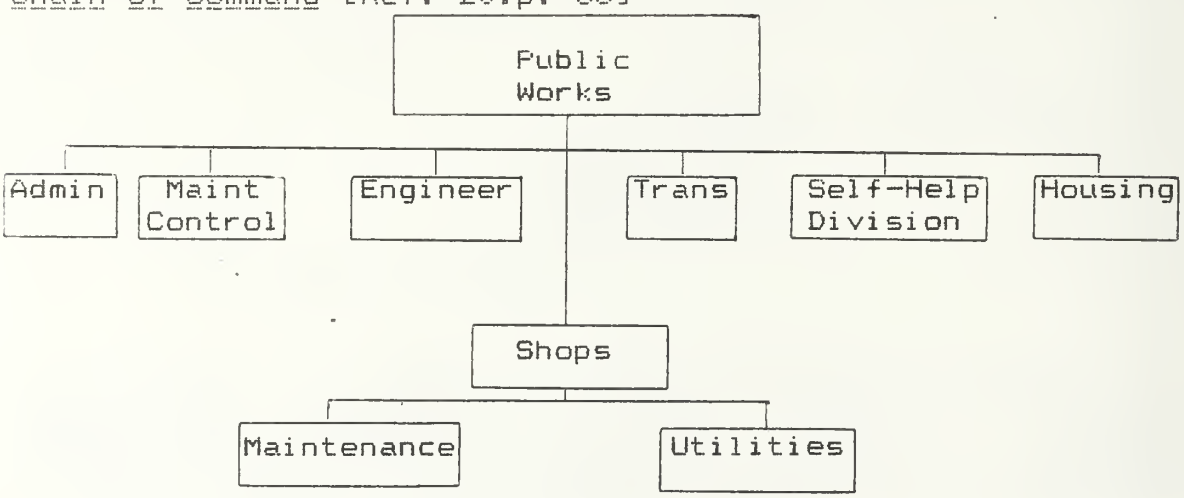


Figure 3.7 Public Works Department

Supply Department (Supp)

Mission: Provides material support to fleet aviation activities, station departments,tenant, and satellite units. Operates the Enlisted Dining Facility, satellite dining facility, Flight Galley, and all unaccompanied personnel housing. [Ref. 20:p. 35]

Chain of Command [Ref. 20:p. 41]

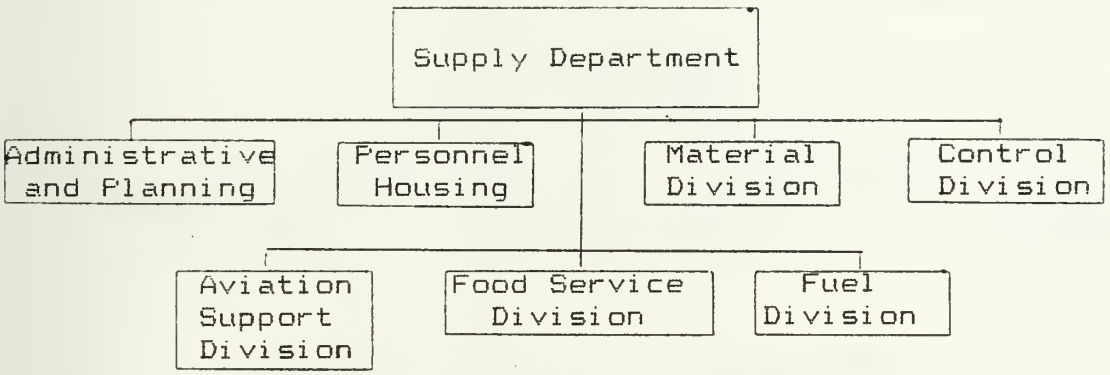


Figure 3.8 Supply Department

Comptroller Department (Comptrol)

Mission: Establishes, coordinates, and maintains an integrated system for financial management. Coordinates budget planning and execution. [Ref. 20:p. 43]

Chain of Command [Ref. 20:p. 45]

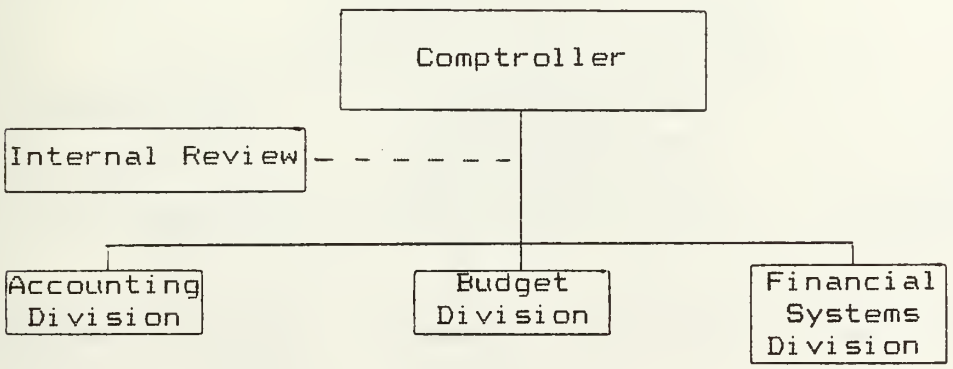


Figure 3.9 Comptroller Department

Operations Department (OPS)

Mission: Operates airfield facilities and provides services to support operations of aircraft. Provides fire fighting functions for the station and for aircraft. Provides air traffic control and maintenance of aviation support electronics equipment. [Ref. 20:p. 47]

Chain of Command [Ref. 20:p. 49]

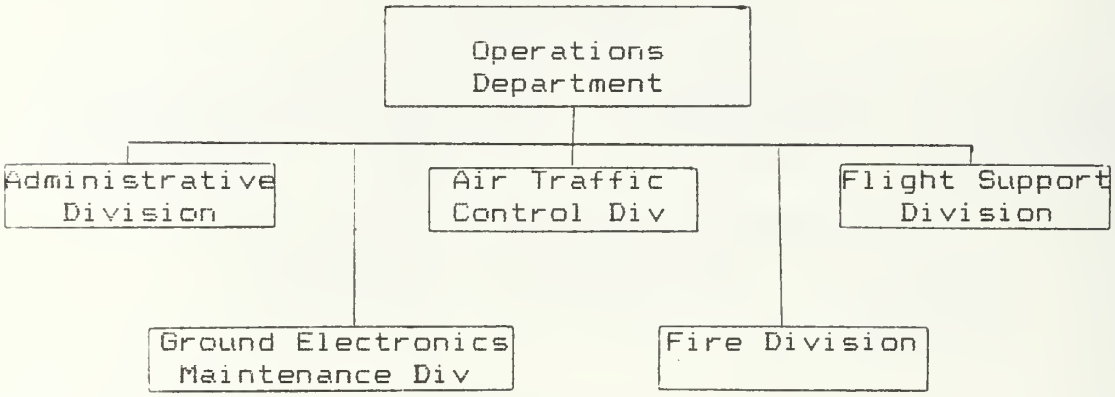


Figure 3.10 Operations Department

Aircraft Intermediate Maintenance Department (AIMD)

Mission: Performs intermediate aircraft maintenance support for aircraft and on associated support equipment. [Ref. 20: p. 51]

Chain of Command [Ref. 20:p. 55]

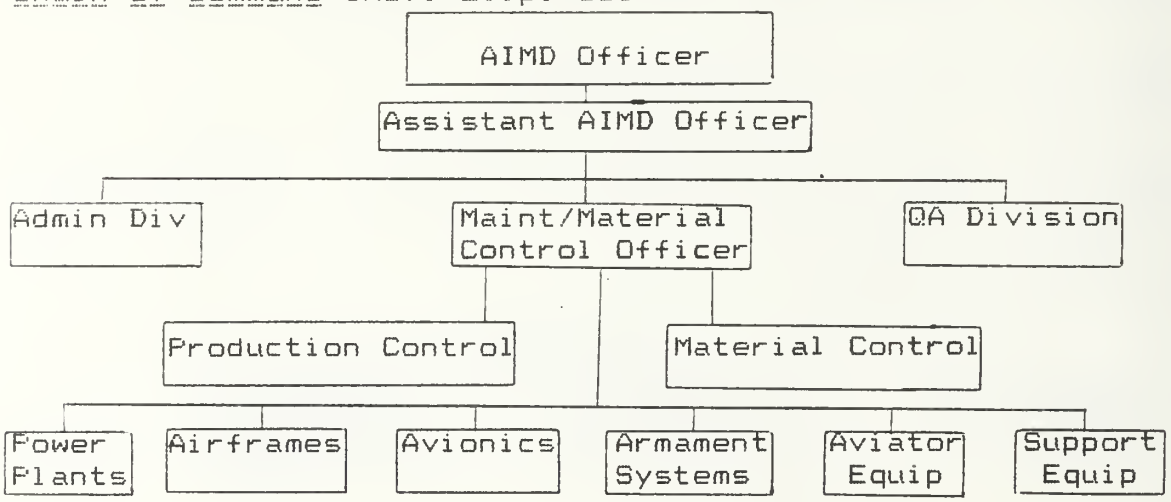


Figure 3.11 Aircraft Intermediate Maintenance Department

Weapons Department (Weaps)

Mission: Maintains and issues all station ordnance. Operates small arms firing range. Provides support to Explosive Ordnance Detachment (EOD), Alameda, when required. [Ref. 20:p.57]

Chain of Command [Ref. 20:p. 59]

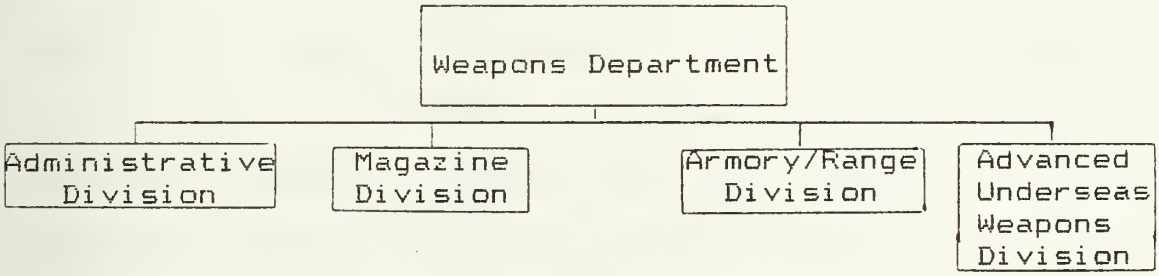


Figure 3.12 Weapons Department

Recreational Services Department (Rec Svcs)

Mission: Provides and supervises social and recreational services. Administrates various messes and recreational divisions. [Ref. 20:p. 61]

Chain of Command [Ref. 20:p. 65]

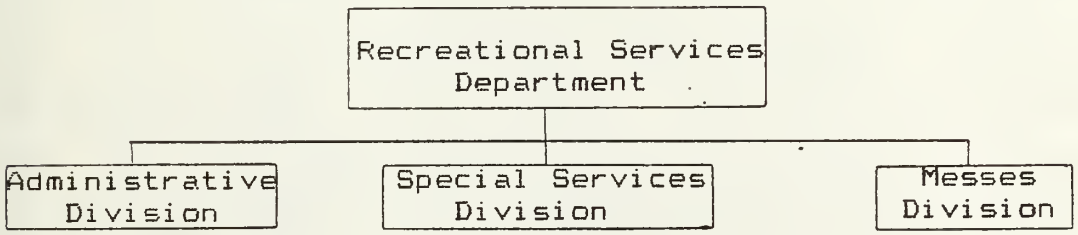
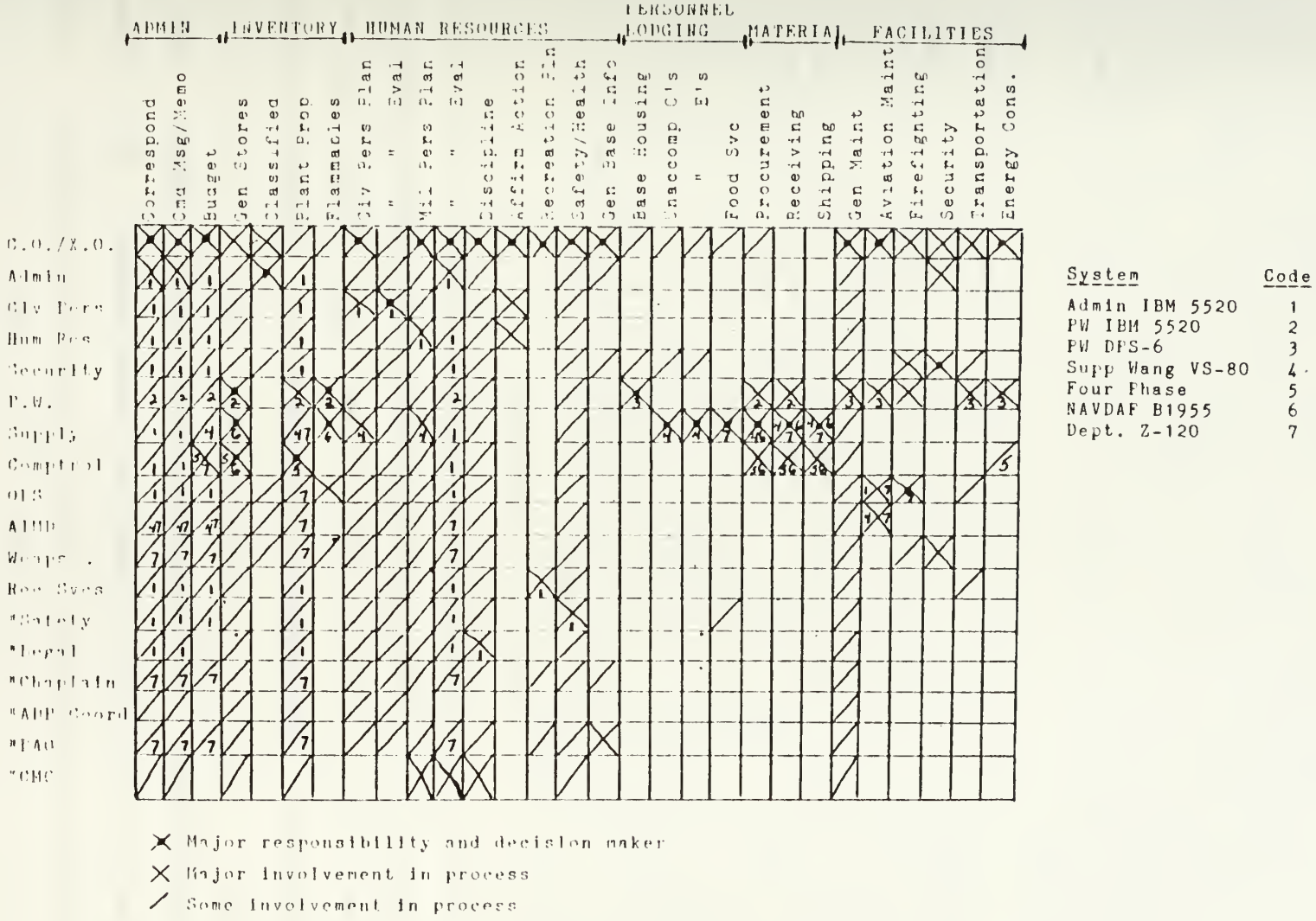


Figure 3.13 Recreational Services Department

synthesis of the organization, the team leader should develop a preliminary list of business processes for the organization. The NISM board can then meet, and modify the list as necessary. The processes can then be placed in a Process and Organization Matrix. Each department representative can then complete the input for his/her department. The team leader will complete the input for the Commanding Officer and the Executive Officer. The team leader should review the results prior to the Commanding Officer's review.

As an illustration, the Process and Organization Matrix for the NAS Moffett Field is detailed on Figure 3.14. For the matrix to be workable, a maximum of 60 processes is recommended [Ref. 14:p. 36].

When completing the Process and Organization Matrix, the NISM team must keep the following discussion in mind: All processes involve the Commanding Officer as the principal decision maker. Because of the number of processes to manage, delegation of authority becomes crucial from the Commanding Officer down through the layers of the organizational structure. Additionally, some processes are guided sufficiently by regulation and law that the Commanding Officer's participation in the day to day decisions is not normally required. For example, the decisions regarding disposition of plant property are normally handled in accordance with regulations. This is



System	Code
Admin IBM 5520	1
PW IBM 5520	2
PW DFS-6	3
Supp Wang VS-80	4
Four Phase	5
NAVDAF B1955	6
Dept. Z-120	7

Figure 3.14 Process and Organization Matrix, Moffett Field

not to say that the Commanding Officer will never become involved in these decisions. Should an aged but necessary piece of equipment be disposed of prior to its replacement arriving, the operational capabilities of the command could be threatened. It is in abnormal events like this that a Commanding Officer will become involved and insure mission compliance.

The Process and Organization Matrix should not represent the extremes, as in the example above. Rather, the model should evince the daily, routine decisions that keep the process going. This requires judgement by the NISM team as they develop the matrix. There may be differences of opinion. In these instances, the Commanding Officer must resolve conflicts, as only he/she has the vantage to interpret who actually is the routine decision maker for a particular process.

F. STEP 5: ANALYZING CURRENT SYSTEMS SUPPORT

After completing the Process and Organization Matrix, the next step is to overlay current ADP systems onto the matrix. This has been done on Figure 3.14 for the analysis done by the author at the NAS Moffett Field.

Departmental representatives should gather this information for their respective departments. When this information has been mapped onto the matrix, the Process and Organization Matrix is complete.

The matrix shows where electronic interfaces exist and where they may be needed. Where electronic interfaces exist, the matrix does not describe how well they work or improvements needed. Where interfaces do not exist for a process, yet inter-departmental interaction is significant, the matrix does not show how or to what degree interaction is needed. Additionally, the matrix shows nothing about intra-departmental electronic interfaces.

The utility of the matrix is that it describes information interaction between departments. It is a top-down view of information resource sharing and what processes current ADP resources support. From this matrix, the Commanding Officer and the NISM team can uncover possibilities for computer support in various processes. In the exercise of developing the matrix, the NISM team will also discover possibilities for computer support. These discoveries need to be documented concisely. The Commanding Officer and the NISM team should discuss and probe these discoveries to determine their feasibility. Should the effort be judged to warrant implementation, the command should include these enhancements in the prototype implementation plan.

In addition to the ADP equipment being depicted on the matrix, a concise written description should be provided. For the NAS Moffett Field, the description was the following.

The Administration Department's IBM 5520 is the most inter-departmentally connected piece of ADP hardware at the NAS Moffett Field. All departments have at least one terminal connected to Administration's IBM 5520, with the exception of Public Works, AIMD, and Weapons. The IBM 5520 owned by Public Works will soon be interfaced with the Administrative Department's IBM 5520.

Public Works also has a Honeywell DPS-6 mini-computer to handle the remainder of their computing needs.

The Four Phase IV/90 supports most of the functions for the Comptroller Department. NAVDAF Moffett Field owns and operates the Four Phase system.

UADPS functions are supported by NAVDAF through their Burroughs 1955 mainframe. Both Supply and Comptroller rely on NAVDAF to fulfill UADPS processing.

Recently, several departments and staff positions have received Zenith 120 microcomputers [Ref. 21]. Departments are: Administration, Comptroller, Operations, Supply, and Weapons. Staff positions are: Chaplain, PAO, Safety, and ADP Coordinator. The Z-120's come with bundled software packages including CP/M, MS-DOS, Wordstar, Lotus 1-2-3, and DBase II. A Z-120 training program was conducted in April 85 to familiarize users with the system.

G. STEP 6: DEFINING THE INFORMATION STRUCTURE

As mentioned previously, the definition of an information structure can be done simultaneously with the definition of the station processes. The product of Defining The Information Structure is a series of SADT diagrams, which will describe the hierarchical layers of information structure, the interfaces necessary for process or task accomplishment, and the controls of information management.

Chapter 2 discussed the SADT diagrams. Figure 2.4 depicts the basic box structure, while Figure 2.5 illustrates one level of a diagram. During this step,

departmental representatives will construct a series of actigrams describing information flow for their respective departments. The team leader will need to instruct the NISM team on the SADT technique. It is recommended that in addition to a formal presentation, the team leader prepare handouts covering the technique with examples; selected parts of this thesis could be copied for reference (e.g. the SADT section in Chapter 2). The SADT diagram process may be difficult for some people to grasp, as many people do not normally analyze in structured patterns [Ref. 12]. Departmental representatives must be taught how to decompose or break apart their departments from the general to the specific. To insure the diagrams will complement each other when put together, it is worth the effort for the team leader to insure all NISM team members thoroughly understand the technique. After all, the team leader will have to detect and resolve diagram conflicts. It is in his/her best interests to insure diagrams conform to SADT standards.

Before allowing department representatives to begin this step, the team leader should decompose the organization, describing the first three layers. This will provide a framework for the departmental representatives to work from.

In addition to SADT instructions, the team leader should provide forms for the decomposition, i.e., blank diagrams. Node assignments and a diagram numbering scheme need to be

coordinated. Organizational chart stencils may also be purchased and distributed, so that drawing the rectangular boxes will be easier for the NISM members.

A question that will arise almost immediately is, "how far do we decompose?" This is a reasonable question, as the SADT process itself does not define how far to go, and an analyst could define all the way down to sharpening pencils, or making a selection on a computer terminal. This degree of decomposition would be a life's work for one analyst in a large department, and would be voluminous and meaningless. To answer this question, analysts must keep the objective of the project in mind. The SADT diagrams should provide a graphical description of functional tasks and interfaces, so that the Bases and Stations prototype can be shaped to fit the organization. Functional relationships of information should be depicted, nothing more, nothing less.

The analysis of the NAS Moffett Field performed on this thesis serves as an illustration. The latter is probably the best way to communicate the SADT process and the degree of decomposition required for a NISM study. In SADT diagrams, the author distinguished between physical and information flows for inputs and outputs. Physical flow is defined as object movement only; e.g., a box of pencils moving from Supply to Administration. Information flow is defined as an object or transmission that with itself imparts meaning; e.g., a supply requisition for a box of pencils is a piece

of paper that flows from Administration to Supply--both parties can impart meaning to the requisition. The depiction of input/output flow type can be used as a gauge to anticipate when decomposition is completed. The following discussion will guide the reader through this technique.

Figure 3.15 depicts a macro view of the SADT process, and the figures that follow. The diagrams form a hierarchical structure, starting with the general and proceeding to the detailed. Level A0 is the NAS Moffett Field. Figure 3.16 depicts Level A0, which describes the NAS Moffett Field in one actigram box called "Formulate and Implement Facility Strategy". Note the physical and information flows for input and output, where information flow appears to dominate.

Figure 3.17 depicts Level A1 which decomposes the actigram box of Level A0, ergo the title of Level A1 diagram matches the actigram box of Level A0. Node A1 is broken down into 3 actigrams. On the diagram, the "Number" ("R1") is used to keep track of which diagram Figure 3.17 references above it, in this case Level A0 (Figure 3.16). The number scheme is strictly relative, but should be consistent; as decomposition proceeds further, a new letter/number pair will be required. On Figure 3.17 note the physical and information flow arrows for input and output; physical flow now appears to dominate.

The three actigrams on Figure 3.17 are decomposed to form Level A2, Figures 3.18, 3.19, and 3.20 (Numbers R2, R3, and R4 respectively). For all three diagrams, note the dominance of physical input/output arrows. The procedure of matching the title of the diagram with the actigram box in the level above it, is maintained. At Level A2, the diagrams are reflecting macro functions that the reader can relate to the processes defined in the Process and Organization Matrix; the processes, which were general in the matrix, are more specific in the SADT diagrams.

Earlier in this section, it was mentioned that the team leader should provide a decomposition of the first three layers to the NISM team. Levels A0, A1, and A2 are depicted in Figures 3.16 thru 3.20 which will provide a framework from where department representatives can decompose further. Nodes have been labeled in this illustration beginning with A0; this need not be so, however a common node labeling scheme should be defined. The "Number" scheme has thus far used "R" followed by a number. Again, this need not be so, but a common numbering scheme should be defined. At this point in the SADT decomposition, the team leader may find it useful to assign each department representative a number, for exclusive use in their departmental SADT diagrams. For example, "B" could be assigned to the Administration Representative and "W" assigned to the Weapons Representative. In this way, the

team leader can keep track of a department's diagrams when consolidating them.

From node A2, the illustration will depict one actigram, decomposing to the functional level. The author chose "R5" (Information Management) to decompose. Figure 3.21 shows the decomposition. At this point, the author chose a new numbering scheme starting with "S1" (Command Communications Management). In Figure 3.21 note the physical and information flows for input/output and the predominance of information flow.

For node A4, the author chose "S1" (Command Communication Management) to decompose. Figure 3.22 shows the decomposition diagram. Note that the physical and information input/output flows depict an almost total domination by information flow. In this particular instance, decomposition has finally resulted in a functional description of information flow. Further decomposition is therefore not required for this branch.

Note that attention should be paid to physical and information input/output flows. In effect, the change in dominance of flow type can serve as a clue to detect when functional decomposition is complete. The decomposition starts with dominance of information flow (level A0), changes to physical flow (levels A1 and A2), changes back to information flow (level A3), and finally at level A4 a clear dominance of information flow is observed. Should

decomposition to further layers be done, a shift back to physical flow dominance would be observed; i.e., the analyst would eventually be defining tasks like sharpening pencils, etc. The flow dominance type can serve as an approximation to determine when decomposition is completed for the NISM study.

The collection of diagrams serve as a graphical representation of the tasks the command does to fulfill its mission(s). Because it describes who does what task, and the interfaces necessary, the document also serves as a nice turnover item for the Commanding Officer to hand to his relief. The incoming Commanding Officer can immediately grasp the scope of the mission(s), i.e., the nuts and bolts of command mission fulfillment. Additionally, the Commanding Officer and department heads can evaluate the diagrams and perhaps discover better organization structures and better information structures, with or without computer systems.

After department representatives have completed the SADT diagrams, the team leader must consolidate the information flows. For most processes, the activity will be department specific and no consolidation is required. For example, referring to Figure 3.19, Number R17 (Firefighting, Rescue, and Investigations) will be handled within the Operations Department at the NAS Moffett Field. Some processes will have overlap between departments. For example, referring to

Figure 3.18, Number R7 (Material Management) will involve chiefly the Supply Department, however other departments will be involved; e.g., the ADP Coordinator will be extensively involved in ADP procurements. Where departments overlap a task, the team leader will need to consolidate the diagrams.

Additionally, the team leader will need to resolve coordination inconsistencies. One department may depict interface with another department, that the latter department neglected to include.

The Defining The Information Structure step will be the most time consuming task for the NISM team. Department representatives of large departments may decide to recruit departmental personnel to aid in the task; in effect, a departmental representative would become a departmental team leader with all of the concomitant teaching and consolidation responsibilities.

H. STEP 7: DETERMINING THE COMMANDING OFFICER'S PERSPECTIVE

Up to now the analysis has been chiefly oriented towards the present, with some documentation on departmental requirements.

This step will allow the Commanding Officer to review the Process and Organization Matrix, SADT diagrams, and other documentation to make decisions regarding information resources and implementation priorities. By making these decisions, the Commanding Officer is in effect determining

critical success factors for the command that can be translated into ADP equipment and organizational structural changes.

With the Commanding Officer's experience of the past and present, he/she now has the opportunity to create the future for the command. Although the current Commanding Officer may not harvest all of the benefits of the Organizational Support System, he/she will pioneer a new management method for the command. As a consequence, the Navy's operational capabilities is expected to be greatly improved.

Table III provides the author's estimate of a time dimension to the NISM study. The estimates are based on a naval station that is the size of the NAS Moffett Field. It must be recognized that the size of the command will alter these figures; i.e., a smaller naval station will compress the estimates and a larger naval station will expand the estimates.

I. STEP 8: DEFINING FINDINGS AND CONCLUSIONS

The team leader must now coordinate the documentation effort so that the Commanding Officer's decisions reflect command requirements. The NISM output provides documentation in a package that may escape the implementor's notice. A concise written document should be prepared which will summarize the requirements and priorities.

As the implementors review the NISM study results, they may uncover and propose additional enhancements to the

TABLE III - TIME DIMENSION TO THE NISM STUDY

	Event Completion (weeks)	Total Elapsed Time (months)
Gaining The Commitment	3	.75
Appoint NISM Team	-	
NISM Study Briefs	-	
Preparing For The Study	3	1.50
NISM Method Briefs	-	
NISM Team Begin To Collect Facts	-	
Starting The Study	2	2.0
Departmental Survey Reports	-	
Command Survey Report	-	
Defining Station Processes	3	2.75
Prepare Command Processes List	1	
Departmental Inputs to Process and and Organization Matrix	1	
Consolidate Matrix and Commanding Officer Review	1	
Analyzing Current Systems Support	4	3.75
Departmental Inputs	2	
Consolidate Process and Organization Matrix, and Documentation	1	
Commanding Officer's Review	1	
Defining The Information Structure	9	6.0
SADT Briefs	1	
Complete Departmental SADT Diagrams	3	
Consolidate SADT Diagrams	3	
Commanding Officer's Review	2	
Determining The Commanding Officer's Perspective	1	6.25
Defining Findings and Conclusions	8	8.25
Prepare Summary Documentation and Brief NISM Team on Information Resource Management Plan	1	
Implementors Submit Implementation Plan	4	
NISM Review	1	
Commanding Officer Finalizes Organizational Support System Design	2	

Implementation Begins.....

Commanding Officer and NISM team. Decisions on these recommendations can be acted upon as they are discovered, or the implementors may provide a consolidated list of suggested enhancements for review.

In any event, all concerned parties must recognize their role and their knowledge base when reviewing requirements or recommendations. After completing the NISM study, the Commanding Officer and the NISM team know how their organization functions better than the implementors. On the other hand, the implementors know ADP and through studying other bases, may have uncovered new innovative management procedures and techniques. Although the users have the final say, open-minded consideration of all recommendations by both parties will realize their common objective; i.e., to develop and implement an Organizational Support System.

The author's study of the NAS Moffett Field was not as complete as a NISM team could do, simply because one analyst cannot cover the ground that a team could. Nonetheless, various findings and conclusions could be derived. They are discussed in Chapter 4.

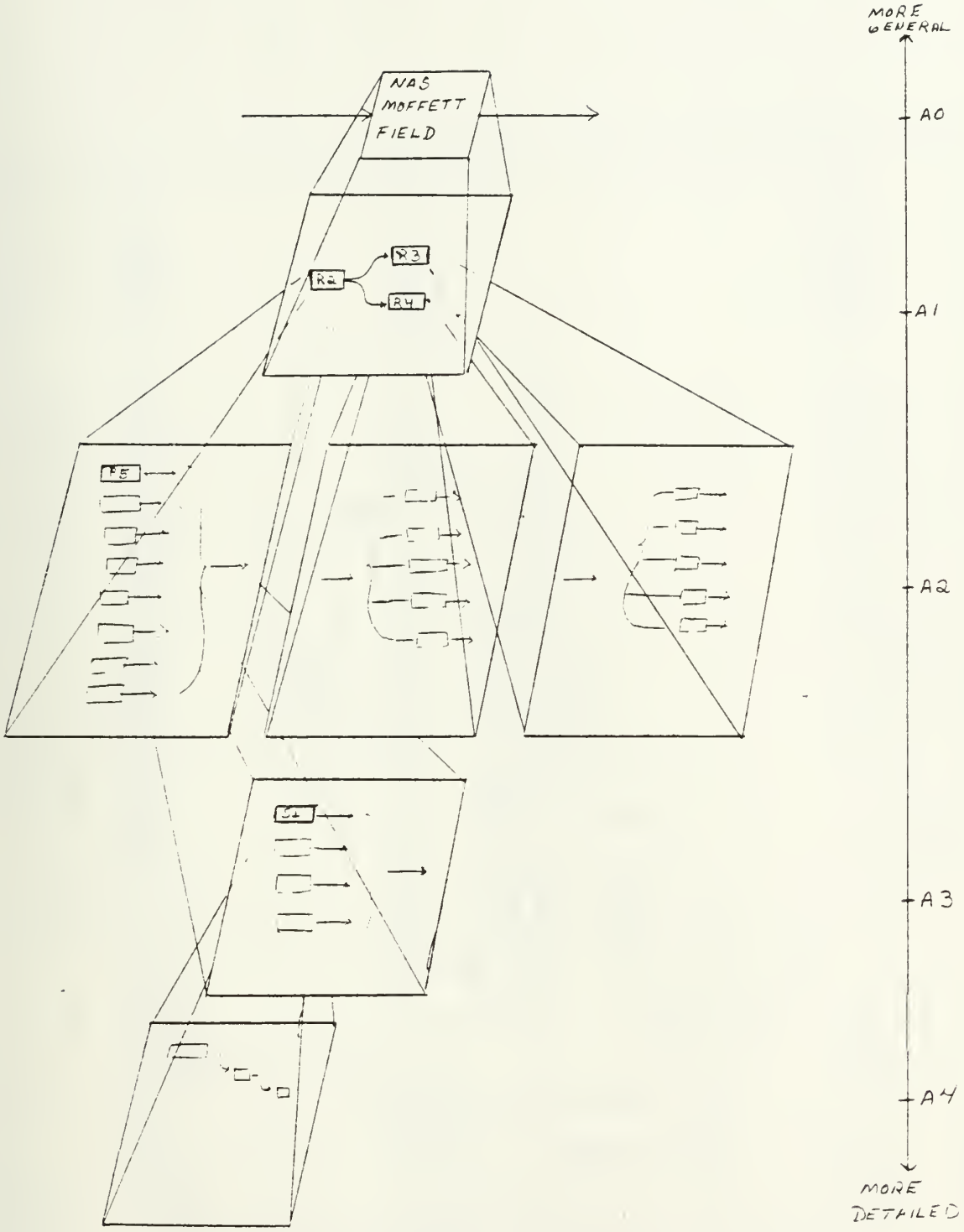


Figure 3.15 NISM Hierarchical Decomposition

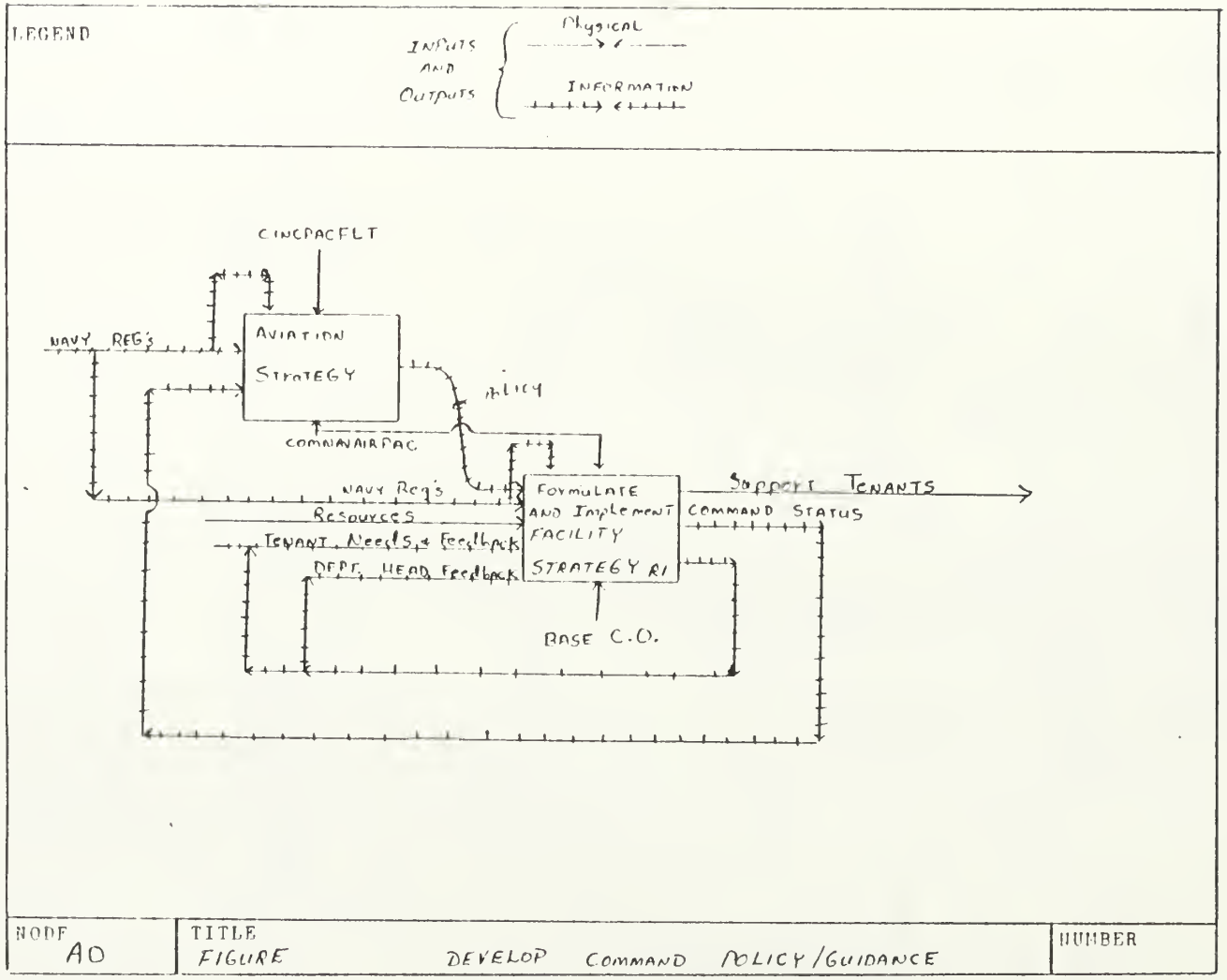


Figure 3.16 Level A0 - NAS Moffett Field

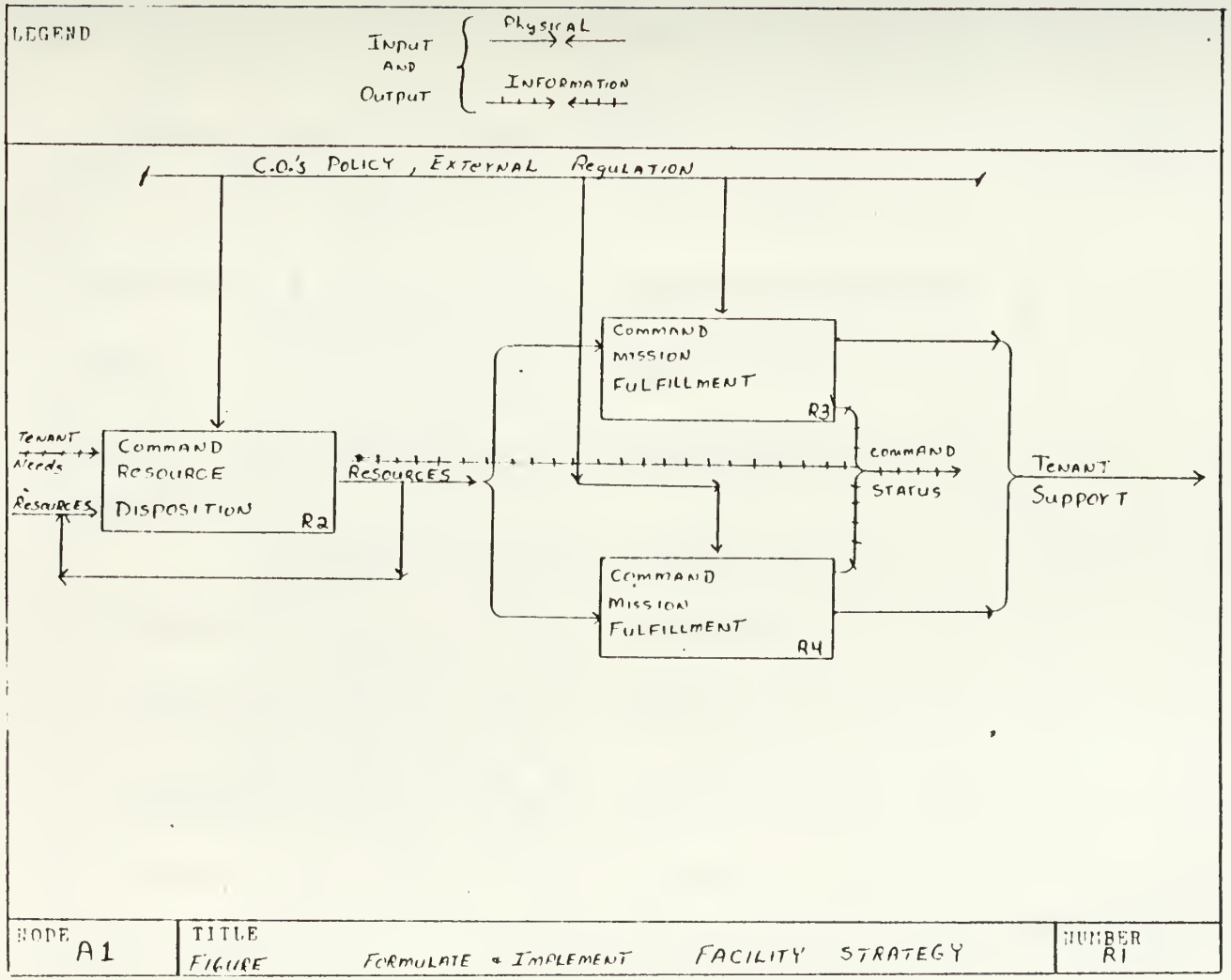


Figure 3.17 Level A1 - NAS Moffett Field

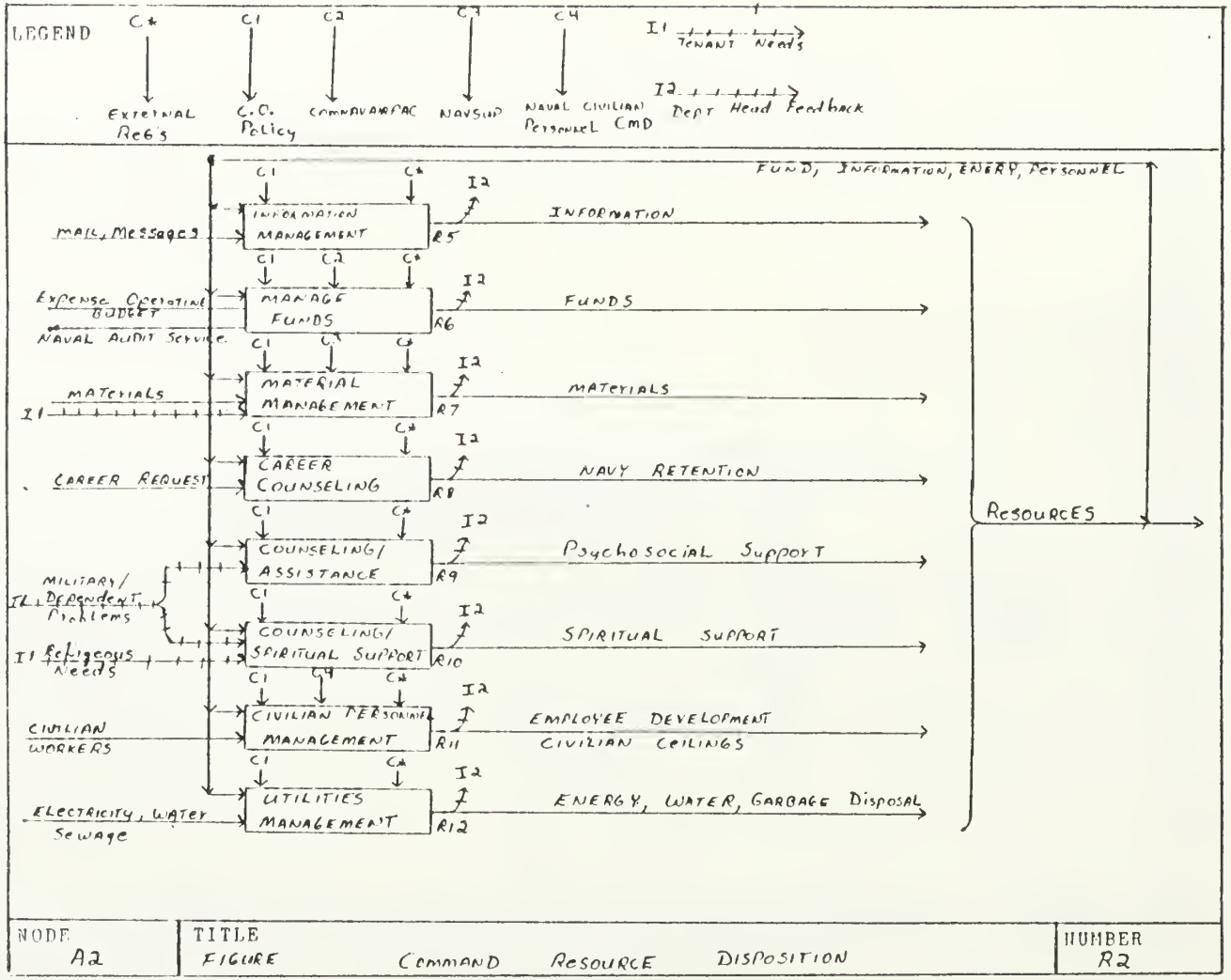


Figure 3.18 - Level A2, Number R2 - NAS Moffett Field

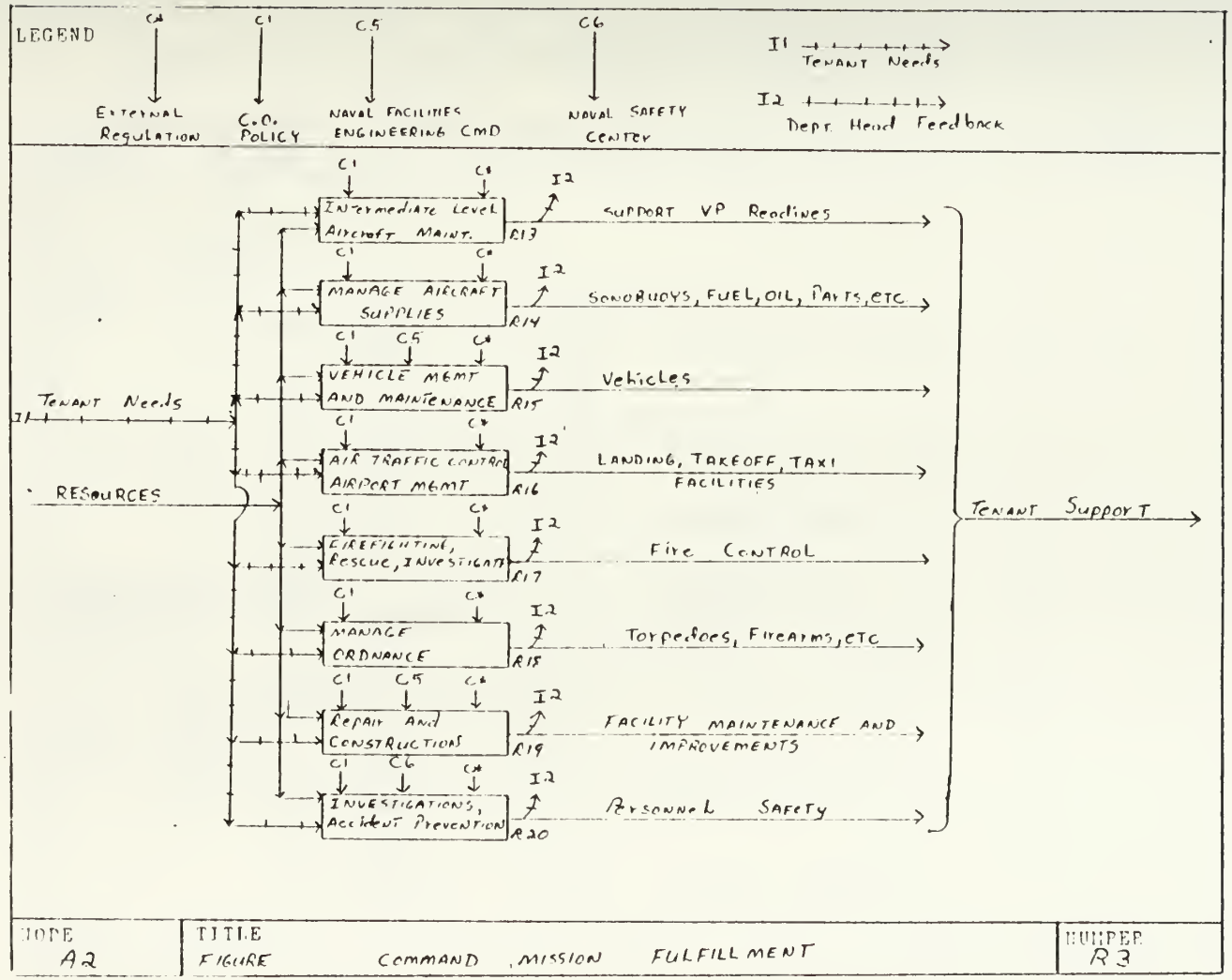


Figure 3.19 Level A2, Number R3 - NAS Moffett Field

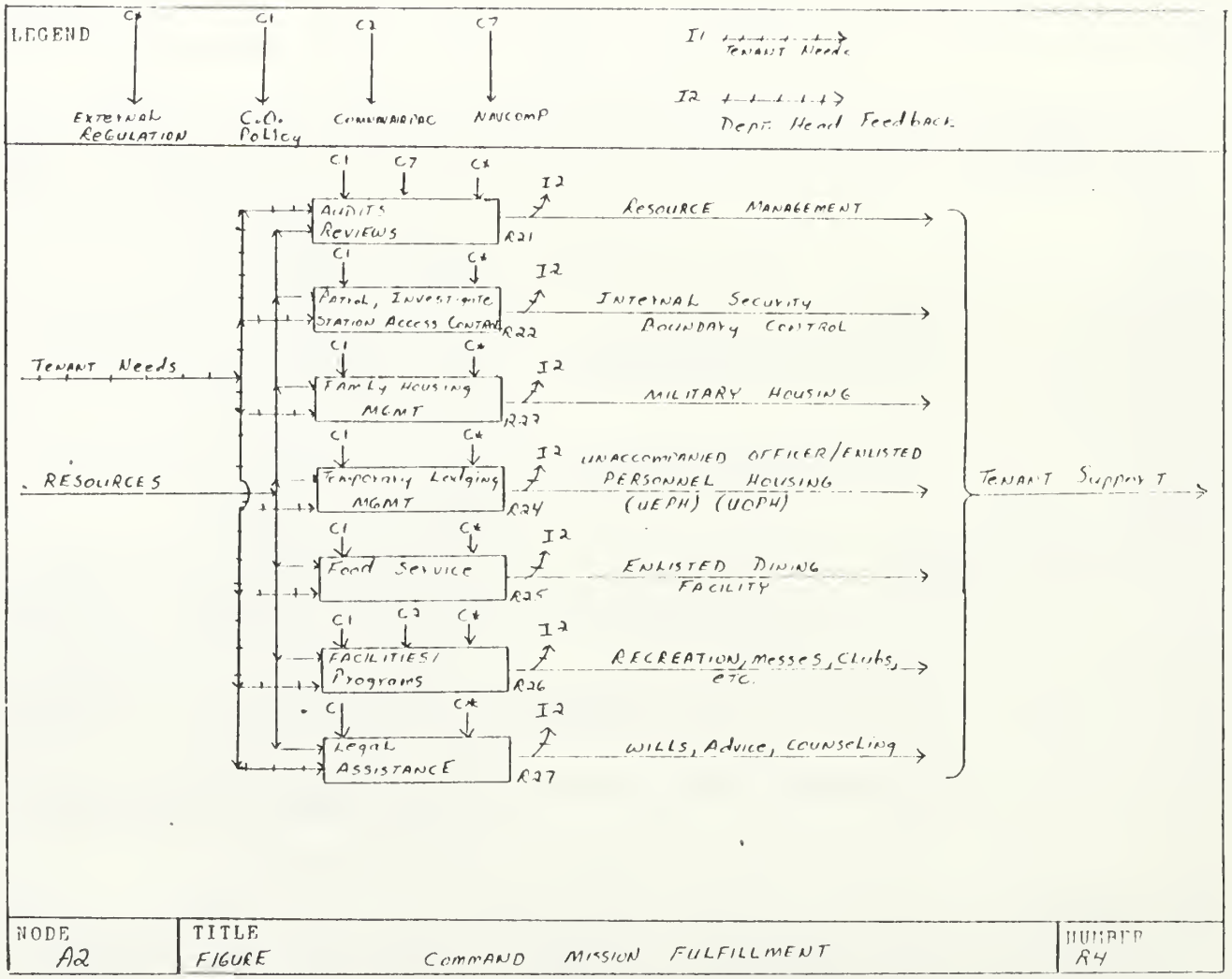


Figure 3.20 Level A2, Number R4 - NAS Moffett Field

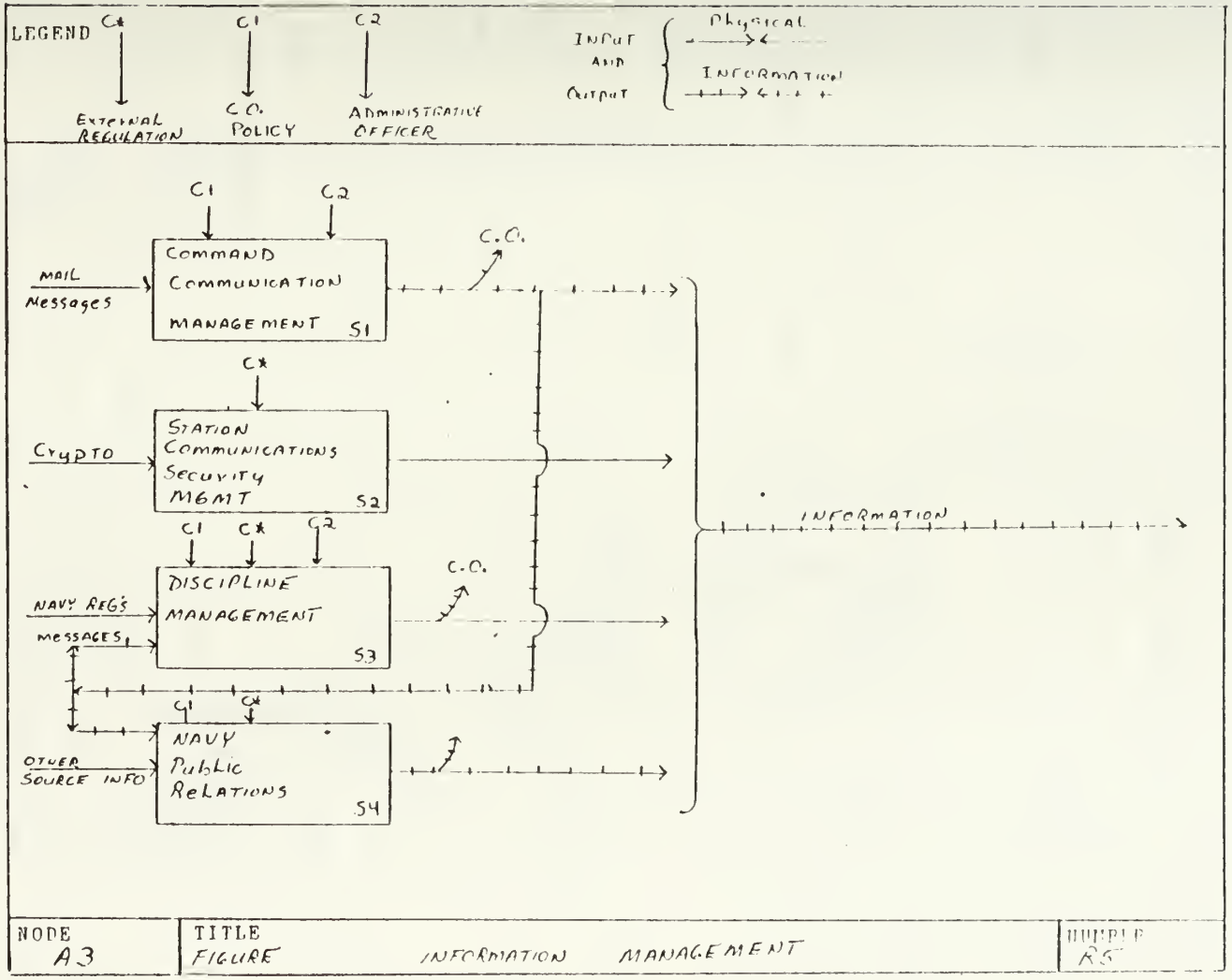


Figure 3.21 Level A3, Number R5 - NAS Moffett Field

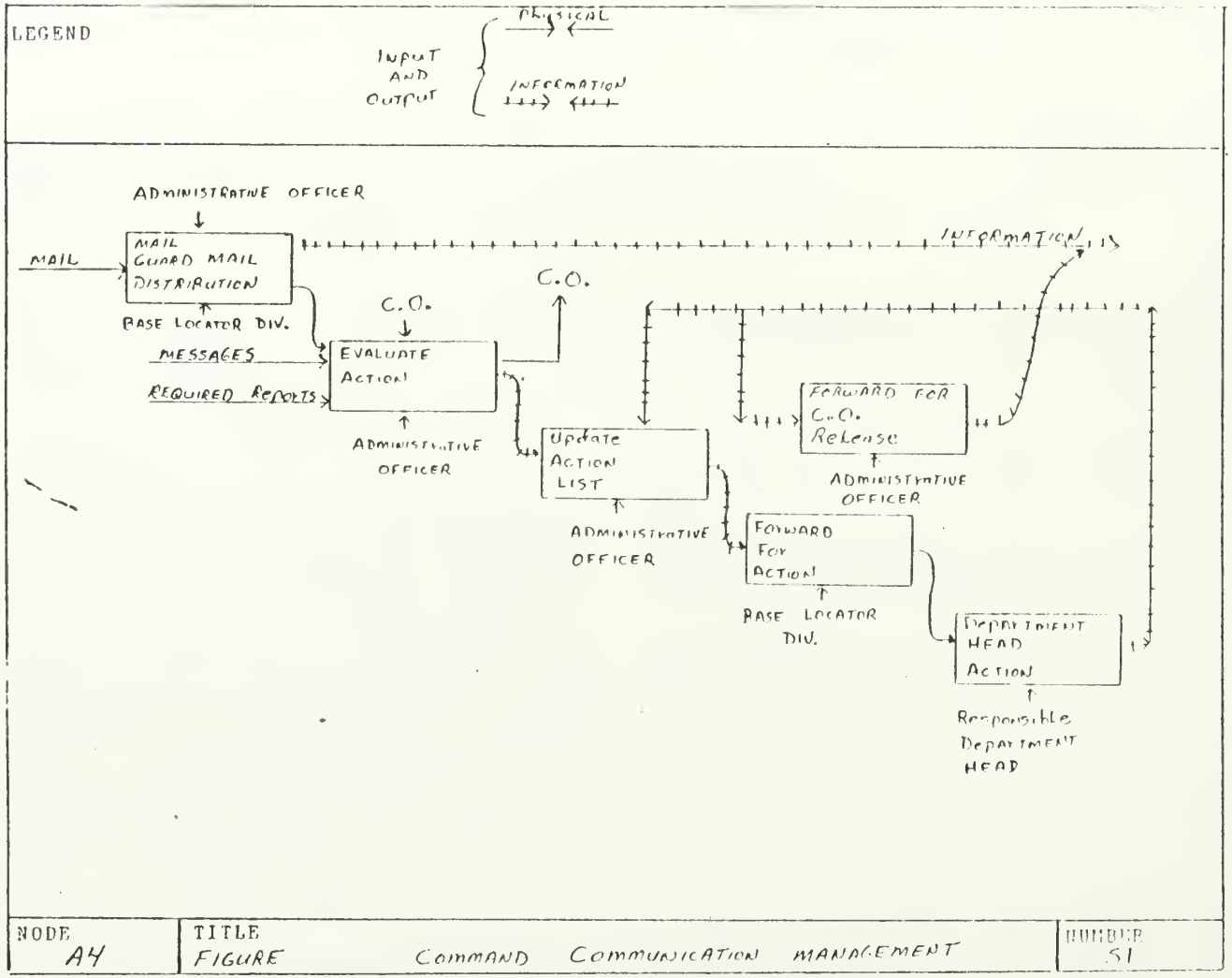


Figure 3.22 Level A4, Number S1 - NAS Moffett Field

IV. DESIGN IMPLICATIONS FOR THE NAS MOFFETT FIELD

A. INFORMATION COORDINATION

The findings derived from the analysis of the NAS Moffett Field are discussed in light of the NISM methodology. One generalization concerns information coordination.

The BSP study and SADT diagrams view the organization from processes or tasks, and attempt to determine common processes that should be interfaced using computer systems. Common processes implies relationship of function which should be coordinated.

Figure 3.17 (level A1) represents a macro functional division of the mission(s) of the NAS Moffett Field. These macro functions can be further subdivided into level A2 (Figures 3.18, 3.19, and 3.20). From the external environment of the NAS Moffett Field, the Command receives resources and information (Figure 3.18). These resources are "processed" to yield a variety of final outputs (Figures 3.19 and 3.20). These outputs serve the system (NAS Moffett Field), internal communities (tenants), and the external environment (community, nation, etc.). All of the functions receive from these resources and produce their respective outputs.

Several functions deal directly with the inputs from the external environment (e.g. Material Management) to facilitate usage by other functions downstream (e.g. Repair and Construction). These functions might be considered boundary spanning functions (Figure 3.18 - "Command Resource Disposition"), for they deal directly with the external environment. This does not imply an importance of boundary spanning functions to that of the other functions (Figures 3.19 and 3.20). A Material Management function by itself cannot fulfill the missions of the base; it exists to support other functions (e.g. Repair and Construction) which will fulfill the missions of the organization. The boundary spanning designation merely states the relationship with the external environment.

At the NAS Moffett Field, most of these functions are accomplished by a single department. Table IV pairs the functions depicted on Figures 3.18, 3.19, and 3.20 with departments that carry out the respective functions. It can be observed, that departments are determined and bounded by their functionality. Presumably this is true at other naval bases as well. This need not be so as groupings can exist for other reasons. Mintzberg [Ref. 22] identifies six motivations for groupings; these are:

1. By knowledge and skill
2. By work process and function
3. By time

TABLE IV - FUNCTION RELATIONSHIP TO DEPARTMENTS TABLE

Functions Allocated to Departments

NUMBER	FUNCTION	DEPARTMENT
R5	Information Mgmt	Admin, Public Affairs
R6	Manage Funds	Comptroller
R7	Material Mgmt	Supply, Public Works, AIMD, ADP Coordinator
R8	Career Counseling	Human Resources, Command Master Chief
R9	Counseling/Assistance	Human Resources, Legal
R10	Counseling/Spiritual Support	Chaplain
R11	Civilian Personnel Mgmt	Civilian Personnel
R12	Utilities Mgmt	Public Works
R13	Intermediate Aircraft Maint.	AIMD
R14	Manage Aircraft Supplies	Supply
R15	Vehicle Mgmt and Maint.	Public Works
R16	Air Traffic Control/Airport	Operations, Safety
R17	Firefighting, Rescue, etc.	Operations, Safety
R18	Manage Ordnance	Weapons
R19	Repair and Construction	Public Works
R20	Accident Prevention, etc.	Safety
R21	Audits, Reviews	Comptroller
R22	Patrol, Access Control, etc.	Security
R23	Family Housing Mgmt	Public Works
R24	Temporary Lodging Mgmt	Supply
R25	Food Services	Supply, Rec. Services
R26	Facilities, Programs	Recreation Services
R27	Legal Assistance	Legal

4. By output

5. By client

6. By place

The base, NAS Moffett Field, could be considered to be grouped by place and client; i.e., because COMPATWINGSPAC and several P-3 squadrons are required to be posted in central California, the NAS Moffett Field exists. Departments are grouped by function, in order to focus management around functionally related tasks. Divisions are probably grouped because of knowledge/skill and output, in order to concentrate expertise on individual tasks; e.g., it would be foolish to place a yeoman in a Weapons shop to repair MK-46 torpedoes.

Because the departments of the NAS Moffett Field are grouped by function, important coordination considerations can be drawn. Mintzberg claims that grouping by functional basis gives way to selective vertical decentralization. Mintzberg delineates five coordination mechanisms [Ref. 22 and Ref. 23]. These are:

1. Mutual Adjustment - individuals coordinate their own work, by communicating informally with each other.

2. Direct Supervision - one person takes responsibility for the work of others through issuing of instructions and monitoring actions.

3. Standardization of Work Processes - contents of work specified or programmed.

4. Standardization of Work Outputs - the results of the work are specified.

5. Standardization of Worker Skills - the kind of training required to perform work is specified.

Functional basis groupings coordinate largely by mutual adjustment [Ref. 22 and Ref. 23]. Indeed, this is what is observed at the NAS Moffett Field.

Department heads run their functional area of responsibility and generally coordinate through the Commanding Officer by mutual adjustment. The department heads brief the Commanding Officer on the running of their functional area, seeking decisions where they are not given by law, instruction, policy, etc. The briefs allow the Commanding Officer and department heads to interact, setting policy and tone for the department head to run his/her department. This is not to say other coordination mechanisms are not used by a Commanding Officer. Should the Commanding Officer detect departmental problems or should the department be assigned a "highly visible" task, a Commanding Officer may resort to direct supervision for a brief period.

Computerization of mutual adjustment coordination is difficult to accomplish. The Commanding Officer's gut feeling about his/her people and the situation will be the principal guide. The infallible computation of a gut feeling is impossible to submit to a machine, at present.

However, computerized decision aids can help the Commanding Officer study the situation and help him/her establish feelings about the situation. Cumbersome

printouts are not what is needed [Ref. 16]. Summary data and graphical displays of situation progress will help a Commanding Officer establish his/her opinion quickly. Should this information prove to be insufficient, mutual adjustment coordination will provide more information to establish the Commanding Officer's opinion and perhaps a change in coordination mechanism. For example, a graphical display of station budget progress against milestones can provide the Commanding Officer with a quick view of the financial situation. Should the budget be significantly ahead or behind of the next milestone, the Commanding Officer will have the Comptroller explain why this is so. The Commanding Officer's opinion about the Comptroller, the budget, and the Comptroller Department may be modified depending on the feedback, such that a new coordination mechanism may be warranted; e.g., direct supervision might be implemented by issuing of a "things-to-do" list, and daily reports.

With the recent purchase of Z-120's and the appropriate software by the NAS Moffett Field, and as soon as Z-120 training is completed, the Commanding Officer will have graphical summary displays at his/her disposal. The Administration's Z-120 is located in the Commanding Officer's office, so that the Comptroller need merely carry a prepared diskette (prepared by the Budget Division) to the Commanding Officer's office for the Commanding Officer

to formulate a decision on the station budget progress, based on a graphical display.

B. INTERPRETATION OF THE PROCESS AND ORGANIZATION MATRIX

Several implications can be ascertained from the study of Figure 3.14 (Process and Organization Matrix).

The procedures for interpreting the Process and Organization Matrix are relatively straightforward. The analyst views each column (or process) and interprets the amount of departmental interface that is transpiring. Then the analyst ascertains the degree of ADP interconnectivity that is present. The analyst must then determine whether or not electronic interface is practical; i.e., the feasibility of computerizing a subsystem or process.

Processes (or columns) will fall into one of four categories. These are:

1. Processes that are common among several organizational entities, that have electronic interface.
2. Processes that are common among several organizational entities that have some or no electronic interface. Interface is desirable.
3. Processes that are common among several organizational entities, however electronic interface is impractical.
4. Processes that have no commonality among organizational entities, and electronic interface is therefore not necessary.

When studying Figure 3.14, one immediate observation is noted--the Commanding Officer has no direct electronic

interface from any of these processes. This should be rectified. In addition to the hardware and software required, methods of process measurement would need to be defined so that only summary data is transmitted to the Commanding Officer. Presumably, the Bases and Stations Architecture analysis will develop and design yardsticks for the processes. This is a difficult task for many processes. For example, referring to Figure 3.14, how can measurement of the General Stores process be summarized? A tally of daily requisitions versus daily requisitions filled will provide some meaningful information, however it will not declare the impact of a requisition that was not filled. For example, it cannot predict the angry phone call from COMPATWINGSPAC when VP-47 has only 3 operational aircraft because Supply does not have any strut washers in the inventory.

Prior to the interpretation of Figure 3.14, the shortcomings of the matrix should be considered. One of the shortfalls of BSP is that not all processes may be included [Ref. 5]. When the analyst is an outsider, his viewpoint is constrained by his background and from data he can collect on his own. An internal analysis would probably yield more processes, as feedback mechanisms would come into play, from personnel more knowledgable about specific processes. Therefore, the following discussion should be taken for what it is, the author's opinion.

1. Administrative Processes

The Administrative processes all fall into category 2. Correspondence and Command Messages/Memo processes must flow through the Administrative Department prior to approval by the Commanding Officer. Almost all departments are tied into Administration's IBM 5520 or will be shortly (Public Works); the remaining departments (Weapons, AIMD) have Z-120's so that written communication can be transported to the Administrative Department on a diskette. There is some electronic interface for the Budget process with the Comptroller, but it is very limited; transporting Z-120 diskettes to the Commanding Officer and Budget division is a very basic electronic interface and could be improved by using a Local Area Network (LAN).

2. Inventory Processes

Sharing of inventories serves two purposes. The first is to locate material not held by the entity. The second is to serve in accounting from one entity to another entity that has administrative control over the material.

Station-wide material location is either general information or can be obtained from Supply. For example, a MK-46 torpedo is held by the Weapons Department and not by Public Works. This is general information that escapes few people's knowledge. Any item that an individual cannot classify as being held by a particular entity, can be obtained from the Supply Department; i.e., "if ya don't

know where to get it, ask Supply". Because of these arguments, it is the author's opinion that interfacing material location between entities serves little purpose.

Accounting for inventory requires separate ledgers to be maintained by the controlling authority and the user. Periodically, visual sighting of the material is done by the user, and the inventory reported to the controlling authority. The controlling authority compares the report against their ledger in order to determine discrepancies. The visual sighting process cannot be computer interfaced. It is the author's opinion that the comparison process between ledgers could be useful however. In this way, the computer could ferret out discrepancies from the two long ledgers.

The main players of General Stores Inventory are Supply and Comptroller. A batch coordination means through NAVDAF's B1955 consolidates location and accounting of inventory. Public Works' warehouse inventory is maintained on their IBM 5520 and Honeywell DPS-6 systems. Other departments carry more specialized inventories (e.g. AIMD - tools, parts; Weapons - torpedoes) or limited inventories (e.g. Administration - stationary, etc.) which are or may be filed with their respective computer systems. Sharing inventory data between entities through computerization has only been done between Supply and Comptroller. The purpose for sharing General Stores inventories would strictly be to

locate material. Again, it is questionable whether or not this would provide any useful function.

The Classified Material and Plant Property inventory processes presently have no electronic coordination. The Administration Department is the inventory controlling authority for classified material, while the Comptroller is the inventory controlling authority for plant property. It is the author's opinion that for both of these processes, ADP could be useful for accounting purposes as discussed above.

For the Flammables inventory, there is essentially no electronic coordination. Because of their concern of flight operations and firefighting contingencies, the Commanding Officer and Operations Department might find this information useful. An electronic bulletin board might be useful in providing quick access to this information.

3. Human Resources Processes

Civilian and Military Personnel Planning is a process coordinated chiefly through face to face contact, due to the ambiguous nature of the process. However, a consolidated personnel database might be useful in answering executive queries like "how many E-3's are married and live off base?" Additionally, a consolidated personnel database could locate a particular individual with minimal effort. Presently at Moffett Field, each department maintains a

roster or file of their own personnel. Personnel Support Detachment Moffett Field maintains the only consolidated list of military personnel, while Civilian Personnel Department maintains the only consolidated list of civilian workers. A consolidated personnel database that all departments could access, would increase flexibility and solve data integrity problems [Ref. 24].

The design of a personnel database would require certain features. In order to conform to Privacy Act regulations, access would need to be controlled, such that a particular password would allow access to only that department's personnel. Administration should have a password to access the entire database in order to answer executive queries. Human Resources should have a password to access only military records in order to track military retention statistics, interviews, etc. Civilian Personnel should have a password to allow writing and access to only all civilian personnel records. Write controls would allow a department to modify only military records belonging to its personnel. The Database Administrator job could be assigned to the ADP Coordinator; once the database was in place, his/her job would generally entail giving passwords to authorized personnel. There are other considerations which must be taken into account when designing the database, such as record field structure (e.g. name, address, phone number, etc.). The author has broached only

a few considerations to provide the reader with some ways in which controls could be implemented. Today's database software can conform to the user's structural and control requirements [Ref. 24]. The user merely needs to make those requirements known to the database designer.

Civilian Personnel Evaluations vary in format so that this may be a difficult process to electronically interface. However Military Personnel Evaluations are standard, and as observed at the NAS Moffett Field, there is a high degree of electronic interface through Administration's IBM 5520 and through Z-120's.

The Discipline process has no electronic interface and would be difficult because of the selective departmental privacy for each case; additionally, the process requires substantial face to face contact. However, a database of disciplinary actions associated with personnel would be useful for Legal and for executive queries.

The Affirmative Action process does not lend itself to ADP for the same reasons as Discipline.

The Recreation Plan process also does not have an electronic coordination method, however face to face contact in these decisions and programs is probably the best means anyhow. However, a bulletin board of the recreation events could be posted electronically, providing the Commanding Officer and department heads with general information.

4. Personnel Lodging Processes

Personnel Lodging would be another application for a common database in the future when an ADP departmental interface exists. Like the personnel database introduced above, access/read/write controls would need to be installed so that Privacy Act regulations are met.

For the Food Services process, an electronic bulletin board listing meal entrees and hours of operation could be provided to facilitate general information station-wide.

5. Material Processes

The material process is determined by regulation and contains complex accounting processes that the author does not intend to address. The analysis of these subprocesses could be the subject of its own thesis. Providing Z-120's to Supply and Comptroller, as has been done, will enable the department heads to provide graphical summaries to the Commanding Officer, enhancing the communication process.

6. Facilities Management Processes

Facilities Management process fits into category 2. General Maintenance can be obtained by a phone call to a trouble desk or through a work request at Public Works, where DPS-6 processing will schedule, estimate, and follow the work progress. An electronic mailbox facility would provide another means for a department to request service.

Statistical summaries are available through the DPS-6 system [Ref. 25].

Maintenance on Aviation related facilities and Firefighting processes also do not have an electronic interface. An electronic bulletin board with aviation aid status (TACAN status, duty runway, etc.), weather conditions (winds, temperature, ceiling, etc.), space available flights, and fire condition might be useful for general station-wide information. The Commanding Officer would certainly find such information useful. A historical database of aviation aid status, space available flights, and fire condition might provide the Operations Officer with information to formulate strategic plans.

A Transportation bulletin board might be useful information to the Commanding Officer and other departments; e.g., the bulletin board could list vehicles, what command they are checked out to, and maintenance pending. Again, a historical database on each vehicle could provide the Public Works Officer with information to formulate strategic plans; in fact, the DPS-6 provides capabilities to do just this [Ref. 25].

Likewise, an Energy Conservation bulletin board would display to what degree departments, tenants, and the base as a whole are using utilities. Historical databases in this process would yield information for Public Works to

formulate strategic plans; again, a DPS-6 module provides this capability [Ref. 25].

C. IMPLICATIONS AND SUGGESTIONS

The installation of ADP at the NAS Moffett Field has been logical in that allocation has been based on function, so that computer systems are applied to departmental processes. Given the lead time of procurement and budget constraints, the author believes that the NAS Moffett Field has made the right choices in managing ADP resources.

Due to the rather extended ADP procurement cycle and external determination of ADP products authorized for procurement, the NAS Moffett Field finds itself with many different vendor products, few of which can communicate with each other. The next generation of ADP growth must be concerned with interfacing these systems.

The primary usage of computing power at the NAS Moffett Field is for word processing and departmental spreadsheets. With the recent acquisition of Z-120's, all departments now have these capabilities. The next generation of ADP growth should extend the uses of computing power so that more interdepartmental coordination can occur electronically.

Allocating ADP resources by department was logical. The departments are functional entities, which required computing power to improve accomplishment of sub-functional tasks and internal coordination. A new ADP strategy should be adopted which concentrates on inter-departmental

coordination and providing the Commanding Officer with information electronically.

In the author's opinion, the purchase of microcomputers, like the Z-120, by the Navy and hence by the NAS Moffett Field, is the correct course for the next generation of ADP growth. The following advantages for naval bases can be cited.

1. Microcomputers can be allocated by department and thus by function.

2. Microcomputers are relatively inexpensive and do not require the personnel support of a mainframe.

3. The programming support and professional advice for microcomputer management is in place. The NARDACs and NAVDAFs offer this support at nominal costs.

4. An ADP Coordinator can centrally manage microcomputer growth through procurement requests.

5. Microcomputers can handle the needs of most departments. Word processing, graphics, spreadsheet, and database are available. The jobs requiring the power of a mainframe or minicomputer are few; e.g., Comptroller accounting, Public Works facilities maintenance, and Supply's material management.

6. Microcomputers are easily transportable. Departments and divisions occasionally relocate to different spaces. Microcomputers are cost effective when relocation is required.

7. Microcomputers are ideal for storage of classified material. A diskette containing classified or privileged data can be locked in a safe and core memory sanitized by turning the machine off.

Because of the advantages of microcomputers, the author believes that future ADP growth at the NAS Moffett Field will be followed by the acquisition of more microcomputers.

This strategy will oppose the inter-departmental interface requirement discussed above. Therefore, a Local Area Network (LAN) will be required in order to facilitate intra- and inter-departmental communications.

For the Bases and Stations project this has important implications. First, concentration of software development will need to be placed on the microcomputer, since these machines will be widely procured; NAVDAC has recognized this and is offering microcomputer programs to solve various needs (e.g. a program for billeting). Secondly, to reduce the cost of the LAN, microcomputers need to be compatible. To interface a varied set of microcomputers will require a plethora of Network Interface Units, adding substantial costs. The Navy needs to settle on a standard so that compatible microcomputers are procured. The Z-120's purchased today will not be fully compatible with the Z-150's purchased tomorrow.

For the NAS Moffett Field, LAN installation will have two problems. These are:

1. Geographical Location. AIMD, Weapons, and Supply's Aviation Support Division are located across the runway from base mainside where the other departments are located. Cables (underground or around the runway) or microwave transmitters could bridge these regions.

2. Compatibility. A spectrum of vendors range from IBM, Wang, Zenith, etc. Network Interface Units will provide the necessary protocol requirements so that compatibility will exist.

The next generation of ADP growth should also consider the use of corporate databases; e.g., a station personnel database as discussed in Section B. Microcomputers will be unable to accommodate this requirement. Therefore, procurement of a minicomputer will be required.

Various general information bulletin boards might also be applied to the LAN as discussed in Section B.

The next generation will provide the Commanding Officer with information faster and with more effective content. The system should not curtail the Commanding Officer and department head face to face contact. The Commanding Officer's perceptions about his/her people requires face to face contact. The department heads' impressions of command priorities require this face to face contact with the Commanding Officer and other department heads. The Organizational Support System should not force the method of coordination to direct supervision at a terminal, by an already time constrained Commanding Officer.

A NISM study allows a command to make information resource decisions for themselves. While a requirements analysis could be contracted out, it leaves the command with a system design that may not fill their expectations. Since the Bases and Stations project will provide a prototype or design framework, an analysis is needed only to tailor the prototype. The necessary scope of the analysis is simplified such that command personnel, trained in basic

analysis techniques, can do the analysis and make design decisions for themselves. This has been the intent of the NISM methodology.

V. CONCLUSIONS

The analysis of the NAS Moffett Field provided a general understanding of information resource management. The following items are significant findings of the study:

1. Departments are bounded by their functionality.
2. Commanding Officer and department head coordination is generally accomplished through mutual adjustment or direct supervision.
3. In the past, ADP resources have been allocated by function.
4. ADP resources are mainly used for word processing and spreadsheets. Exceptions noted are Supply's transaction processing of requisitions and AIMD's data reduction and accounting functions.
5. Except in the case of the Administration Department's IBM 5520, there is little ADP interface among all departments.
6. Considering the protracted procurement cycle, ADP resource management has been logical.
7. The ADP strategy for today needs to be defined. It is the author's opinion that the strategy should be directed to electronically interfacing entities, i.e., the Commanding Officer, the Executive Officer, and the departments.

The range of duties and responsibilities by a naval station Commanding Officer will not be reduced by computerization. If anything, trends indicate an increase in the Commanding Officer's responsibilities; e.g., recently Commanding Officers can be held accountable for the purchase price of material. Computers can provide more

meaningful and timely results to a Commanding Officer so that the management scope can be accommodated. Likewise, all organizational personnel can obtain timely and effective information by a properly designed system. This is the objective of an Organizational Support System.

Appendix A provides a checklist for the users in conducting the NISM study. This thesis should be consulted for amplification of the steps.

The NISM methodology provides the command with the opportunity to evaluate their own information resources. The Bases and Stations prototype will be a system that is designed based on a few naval stations. NISM allows a command to tailor the prototype to their needs. Additionally, NISM teams may discover new information management requirements that the prototype does not address. Therefore, the implementors (NAVDAC, NARDAC, or NAVDAF) may be presented with user-driven modules that they can incorporate into the prototype package.

The NISM methodology has been tailored for the non-professional ADP analyst. Thus, NISM results would not be detailed enough to develop the prototype; i.e., the SADT diagrams of the NISM technique would need to decompose the organization further in order to develop the prototype. NISM is directed at shaping the prototype.

The naval bases and NAVDAC may decide that professional instruction and guidance on the technique are needed.

NAVDAC professionals could visit the naval base and prepare the NISM team members in the technique beforehand. Although the NISM technique is directed towards the non-professional analyst, the author feels that users may have difficulties preparing SADT diagrams in particular. NAVDAC professionals could provide the guidance to insure the NISM results are meaningful to the users and to the implementors.

The Bases and Stations prototype will eliminate the need for a full requirements analysis at each naval base. Since naval bases perform similar functions, an analysis is needed that only takes into account organizational structure, information structure, and current ADP systems. NISM provides this.

The Bases and Stations project along with a NISM study will have the following advantages for each naval base:

1. Overall costs will be reduced. A traditional life cycle at each base is not necessary, and current ADP will be integrated into each Organizational Support System.

2. Time of development will be reduced. Only one full requirements analysis will be done, to develop the prototype.

3. System design will be user-driven. Each naval station will drive the shaping of their own Organizational Support System.

4. Each naval station will have the opportunity to review afresh their particular organizational and information structures.

A disadvantage to this approach is the effort required by each naval station. Considerable time and effort will be

required by the users to accomplish a NISM study. The study results and resulting Organizational Support System design will be a reflection of the effort expended by a naval station. The success of the system becomes the responsibility of the naval station. If the system design fails, the naval station can only blame themselves, in general.

For this reason, emphasis is placed on commitment of the naval station to the study. Additionally, consideration should be given to NAVDAC instruction in the technique to the naval stations.

APPENDIX A: NISM CHECKLIST

I. GAINING THE COMMITMENT

A. Commanding Officer appoint a NISM Team Leader.

B. Commanding Officer and Team Leader brief Department Heads on the study and the impact of the study results.

C. Department Heads select NISM departmental representatives.

D. First NISM Team meeting.

1. Commanding Officer brief the team on the importance of study.

2. Team Leader brief the team on the overview of the NISM study and on departmental representative duties.

II. PREPARING FOR THE STUDY

A. Team Leader instruct the NISM team on the study methodology.

B. NISM team begin collecting facts.

III. STARTING THE STUDY

A. Each departmental representative prepare a concise description of their department's function and a chain of command diagram.

1. Departmental representatives interview top managers within their department to obtain an overview of processes, functions, and information needs.

2. Document concisely, but precisely, what the department's ADP requirements are.

B. After all departmental surveys are turned in to the Team Leader, the Team Leader should prepare a command functional description and chain of command diagram.

IV. DEFINING STATION PROCESSES

A. Team Leader develop a preliminary list of organizational processes.

B. Using the list prepared in (A), NISM team meet and determine the organizational processes(Maximum of 60).

C. Departmental representatives prepare departmental input to Process and Organization Matrix.

1. Take each column (or process) of the matrix individually, and mark accordingly. Does your department have:

a. Major responsibility for the process { X }; i.e., your department is the major decision maker in the day to day process tasks.

b. Major involvement in the process { X }; i.e., your department plays a key role in the process.

c. Some involvement in the process { / }; i.e., your department plays a role in the process.

2. Verify the departmental input with your department head.

3. Submit the departmental input to the Team Leader.

D. Team Leader consolidate all departmental inputs into a Process and Organization Matrix.

E. Team Leader complete the Commanding Officer's and the Executive Officer's inputs to the Process and Organization Matrix. Use the same marking scheme defined above.

F. Team Leader submit the matrix to the Commanding Officer for review.

V. ANALYZING CURRENT SYSTEMS SUPPORT

A. Distribute the Process and Organization Matrix to the NISM team.

B. Departmental representatives overlay the matrix with their current ADP systems.

1. Determine what ADP systems are in your department, and which processes they contribute to.

2. Note any additional ADP needs, and document them.

3. Note any weaknesses of the current ADP in fulfilling your department's contribution to each process. Document them concisely.

4. Submit the matrix and the documentation to your department head for review and comment.

5. Submit the completed matrix and documentation to the Team Leader.

C. Team Leader consolidate the departmental inputs into the Command Process and Organization Matrix.

1. Complete a summary of command ADP resources.

2 Complete the Commanding Officer's and the Executive Officer's inputs to the matrix.

3. Submit the completed matrix and the department documentation to the Commanding Officer for review.

D. Team Leader provide copies of the Command Process and Organization Matrix to the NISM team members.

VI. DEFINING THE INFORMATION STRUCTURE

A. Team Leader brief the NISM team on SADT diagrams. Briefs should cover the mechanics of the technique, as well as the motivation for the technique.

B. Team Leader distribute blank forms, documentation of SADT technique, organizational chart stencils, SADT diagrams for first 3 hierarchical layers, and numbering scheme.

C. Departmental representatives complete SADT diagrams for their departments.

D. Team Leader consolidate SADT diagrams after all departmental inputs received.

1. Consolidate overlapped processes.

2. Resolve coordination inconsistencies.

E. Team Leader submit the completed SADT package to the Commanding Officer for review.

VII. DETERMINING THE COMMANDING OFFICER'S PERSPECTIVE

A. Team Leader gather the Commanding Officer's perspective on the study results.

1. Information resource decisions and priorities.

2. Organizational structural decisions.

VIII. DEFINING FINDINGS AND CONCLUSIONS

A. Team Leader prepare the summary document on the command's information resource management plan.

B. Team Leader submit the summary document to the Commanding Officer for final review.

C. After summary document is returned, Team Leader brief the NISM team on the command's information resource management plan.

D. Implementors review the NISM study.

E. Implementors submit the implementation plan. Proposed enhancements are to be included.

F. NISM team review the implementation plan. In light of the implementation plan, submit the NISM team recommendations to the Commanding Officer.

G. Commanding Officer review the implementation plan and the NISM team recommendations.

H. Commanding Officer and implementors meet to finalize Organizational Support System design.

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